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PATENT ABSTRACTS OF JAPAN

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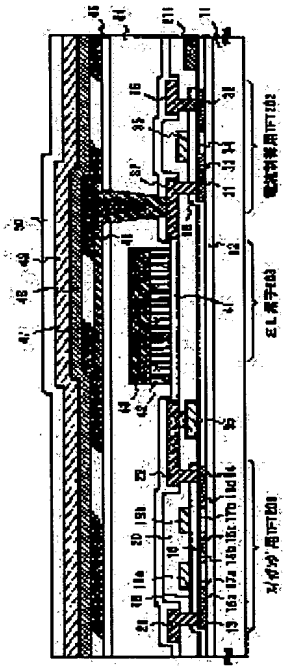
(54) OPTO-ELECTRONIC DEVICE, ITS MAKING METHOD, AND ELECTRONIC DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an EL display device with high operating performance and reliability.

SOLUTION: A third passivation film 45 is provided beneath an EL element 203 made up of a pixel electrode (positive electrode) 46, an EL layer 47, and a negative electrode 48, thereby radiating the heat generated in the EL element 203. The third passivation film 45 prevents an alkaline metal in the EL element 203 from being diffused toward a TFT (thin-film transistor), and prevents water and oxygen from invading from the TFT side into the EL element 203. Preferably, a heat radiating effect is also given to a fourth passivation film 50 to cause the EL element 203 to be surrounded by heat radiating layers.



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CLAIMS

[Claim(s)]
[Claim 1] The electro-optic device characterized by being in contact with the insulator layer in which an EL element contains at least one element chosen from B (boron), C (carbon), and N (nitrogen), and at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn).
[Claim 2] The electro-optic device characterized by the EL element being in contact with the insulator layer which becomes with either the nitride of aluminum, the carbide of silicon, the nitride of silicon, the nitride of boron, the phosphide of boron or the oxide of aluminum.
[Claim 3] the electro-optic device characterized by the EL element being in contact with the insulator layer (however, M -- rare earth elements -- at least -- a kind and at least one element preferably chosen from Ce (cerium), Yb (ytterbium), Sm (samarium), Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium)) containing Si, aluminum, N, O, and M.
[Claim 4] The electro-optic device characterized by the EL element being in contact with the carbon film.
[Claim 5] It is the electro-optic device characterized by said carbon film being the diamond film or diamond-like carbon film in claim 4.
[Claim 6] The electro-optic device characterized by being surrounded by the insulator layer in which an EL element contains at least one element chosen from B (boron), C (carbon), and N (nitrogen), and at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn).
[Claim 7] The electro-optic device characterized by the EL element being surrounded by the insulator layer which becomes with either the nitride of aluminum, the carbide of silicon, the nitride of silicon, the nitride of boron, the phosphide of boron or the oxide of aluminum.
[Claim 8] the electro-optic device characterized by the EL element being surrounded by the insulator layer (however, M -- rare earth elements -- at least -- a kind and at least one element preferably chosen from Ce (cerium), Yb (ytterbium), Sm (samarium), Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium)) containing Si, aluminum, N, O, and M.
[Claim 9] The electro-optic device characterized by the EL element being surrounded by the carbon film.
[Claim 10] It is the electro-optic device characterized by said carbon film being the diamond film or diamond-like carbon film in claim 9.
[Claim 11] It is the electro-optic device characterized by connecting with the 2nd TFT which has the gate where said EL element was electrically connected to the 1st TFT in any 1 of claim 1 thru/or claims 10 electrically.
[Claim 12] It is the electro-optic device which said 1st TFT is a component for switching, and is characterized by said 2nd TFT being a component for current control in claim 11.
[Claim 13] In claim 11, said the 1st TFT and said 2nd TFT are prepared on the insulator layer prepared on the substrate. This insulator layer At least one element chosen from B (boron), C (carbon), and N (nitrogen), The insulator layer containing at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn), or the insulator layer (however, M -- rare

earth elements — at least — a kind —) containing Si, aluminum, N, O, and M Preferably Ce (cerium), Yb (ytterbium), Sm (samarium), The electro-optic device characterized by being either of at least one element chosen from Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium).
[Claim 14] It is the electro-optic device characterized by for said insulator layer carrying out a laminating to the oxidation silicon film, a silicon nitride film, or the nitriding oxidation silicon film in any 1 of claim 1 thru/or claims 10, and being prepared.
[Claim 15] It is the electro-optic device characterized by forming said EL element above the resin film in any 1 of claim 1 thru/or claims 11, and preparing said insulator layer between this resin film and said EL element.
[Claim 16] The electronic instrument characterized by having the electro-optic device indicated by claim 1 thru/or claim 15.
[Claim 17] The production approach of the electro-optic device characterized by having the process which forms two or more TFT(s) on a substrate, the process which forms a wrap insulator layer for said two or more TFT(s), the process which forms the passivation film on said insulator layer, and the process which forms an EL element on said passivation film.
[Claim 18] It is the production approach of the electro-optic device characterized by said insulator layer being resin film in claim 17.
[Claim 19] In claim 17 or claim 18 said passivation film At least one element chosen from B (boron), C (carbon), and N (nitrogen), The insulator layer containing at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn), or the insulator layer (however, M — rare earth elements — at least — a kind —) containing Si, aluminum, N, O, and M Preferably Ce (cerium), Yb (ytterbium), Sm (samarium), The production approach of the electro-optic device characterized by being either of at least one element chosen from Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium).
[Claim 20] The process which forms two or more TFT(s) on a substrate, and the process which forms a wrap insulator layer for said two or more TFT(s), The process which forms the 1st passivation film on said insulator layer, and the process which forms an EL element on said 1st passivation film, The production approach of the electro-optic device characterized by having the process which forms the passivation film of a wrap 2nd for said EL element, and surrounding said EL element with said 1st passivation film and the 2nd passivation film.
[Claim 21] It is the production approach of the electro-optic device characterized by said insulator layer being resin film in claim 20.
[Claim 22] It is the production approach of the electro-optic device characterized by being an insulator layer containing at least one element with which said 1st passivation film and said 2nd passivation film were chosen from B (boron), C (carbon), and N (nitrogen) in claim 20 or claim 21, and at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn).
[Claim 23] In claim 20 or claim 21 said 1st passivation film and said 2nd passivation film the insulator layer (however, M — rare earth elements — at least — a kind —) containing Si, aluminum, N, O, and M Preferably Ce (cerium), Yb (ytterbium), Sm (samarium), The production approach of the electro-optic device characterized by being at least one element chosen from Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium).
[Claim 24] The production approach of the electro-optic device characterized by including the process which forms the insulator layer which contains at least one element chosen from B (boron), C (carbon), and N (nitrogen) between said substrate and said two or more TFT(s), and at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn) in claim 17 or claim 20.
[Claim 25] In claim 17 or claim 20 between said substrate and said two or more TFT(s) the insulator layer (however, M — rare earth elements — at least — a kind —) containing Si, aluminum, N, O, and M Preferably Ce (cerium), Yb (ytterbium), Sm (samarium), The production approach of the electro-optic device characterized by including the process which forms at least one element chosen from Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy

(dysprosium), and Nd (neodium).

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electronic instrument (electron device) which has the electro-optic device represented by EL (electroluminescence) indicating equipment which made the semiconductor device (component using a semi-conductor thin film) on the substrate, and was formed, and its electro-optic device as a display display (it is also called a display).
[0002]
[Description of the Prior Art] In recent years, on the substrate, the technique which forms TFT progresses sharply and application development to a active-matrix mold display is furthered. Since electric field effect mobility (it is also called mobility) is higher than TFT which used the conventional amorphous silicon film, high-speed operation is possible for especially TFT using the polish recon film. Therefore, it is possible to perform control of a pixel in the drive circuit besides a substrate conventionally in the drive circuit formed on the same substrate as a pixel.
[0003] Such a active-matrix mold display attracts attention noting that various advantages, such as reduction of a manufacturing cost, a miniaturization of a display, a rise of the yield, and reduction of a throughput, are acquired by making various circuits and components on the same substrate.
[0004] A active-matrix mold EL indicating equipment prepares the switching element which becomes each of each pixel by TFT, operates the driver element which performs current control by the switching element, and makes EL layer (luminous layer) emit light. For example, the United-States-patent number No. (Japan public-presentation official report: refer to JP,8-234683,A) 5,684,365, the Japan public-presentation official report: There is an EL display indicated by JP,10-189252,A.
[0005] In these EL display, degradation of EL ingredient by moisture poses a problem. Especially an organic system EL ingredient deteriorates not only by moisture but by oxygen. Therefore, it was common to have changed an EL element into a sealing condition and to have intercepted from moisture etc. as indicated by JP,8-78159,A.
[0006] However, the problem which EL layer has is not only moisture. EL layer contains alkali metal, such as sodium (Na), in itself, and if the alkali metal is spread to TFT, it can cause the serious failure for actuation of TFT. Moreover, since EL layer is weak with heat, degradation by accumulation also poses a problem. In addition, in this specification, it is called "alkali metal" including alkali metal and alkaline earth metal.
[0007]
[Problem(s) to be Solved by the Invention] This invention is made in view of the above-mentioned conventional technique, and let it be a technical problem to offer the engine performance of operation and a reliable electro-optic device, especially EL display. And let it be a technical problem to raise the quality of the electronic instrument (electron device) which has it as a display for a display by raising the image quality of an electro-optic device.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned technical problem, in this invention, degradation by the water of an EL element, degradation by heat, and emission

of alkali metal are prevented. It considers as the condition of having specifically prepared the insulator layer which may fill these to coincidence in contact with the EL element, or having surrounded the EL element still more preferably as such an insulator layer is also.
[0009] That is, the insulator layer which there is the blocking effectiveness over moisture and alkali metal, and also has the heat dissipation effectiveness is prepared in the location near [as possible] an EL element, and degradation of an EL element is controlled by this insulator layer.
[0010] Moreover, when such an insulator layer cannot be used by the monolayer, the laminating of the insulator layer which has the blocking effectiveness over moisture and alkali metal, and the insulator layer which has the heat dissipation effectiveness can be carried out, and it can also be used. Furthermore, the laminating of the insulator layer which has the blocking effectiveness over moisture, the insulator layer which has the blocking effectiveness over alkali metal, and the insulator layer which has the heat dissipation effectiveness can be carried out, and it can also be used.
[0011] Anyway, in order to control degradation (you may call it degradation of an EL element) of EL layer, it is necessary to take the cure to heat, moisture, and alkali metal against the TFT itself which must take a cure with both moisture and heat against coincidence, and drives an EL element.
[0012]
[Embodiment of the Invention] The gestalt of operation of this invention is explained using drawing 1 and drawing 2 . It is the sectional view of the pixel of EL display which is this invention which was shown in drawing 1 , and drawing 2 (A) is the plan and drawing 2 (B) is the circuitry. Two or more arrays of such a pixel are carried out in fact at the shape of a matrix, and the pixel section (image display section) is formed.
[0013] In addition, the sectional view of drawing 1 shows the cutting plane cut by A-A' in the plan shown in drawing 2 (A). Since the common sign is used by drawing 1 and drawing 2 here, it is good to refer to both drawings suitably. Moreover, both are the same structures although two pixels are illustrated in the plan of drawing 2 .
[0014] In drawing 1 , it is the insulator layer (henceforth the substrate film) from which 11 becomes a substrate and 12 becomes a substrate. As a substrate 11, a glass substrate, a crystallized glass substrate, a quartz substrate, a silicon substrate, a ceramic substrate, a metal substrate, or a plastic plate (plastic film is also included) can be used.
[0015] Moreover, although especially the substrate film 12 is effective when using the substrate containing movable ion, and the substrate which has conductivity, you may not prepare in a quartz substrate. What is necessary is just to use the insulator layer containing silicon (silicon) as substrate film 12. In addition, in this specification, "the insulator layer containing silicon" points out the insulator layer which specifically contains silicon, such as oxidation silicon film, a silicon nitride film, or nitriding oxidation silicon film (shown by SiOxNy), oxygen, or nitrogen at a predetermined rate.
[0016] Moreover, it is effective to make generation of heat of TFT emit by giving the heat dissipation effectiveness to the substrate film 12, also in order to prevent degradation of TFT, or degradation of an EL element. All well-known ingredients can be used for giving the heat dissipation effectiveness.
[0017] Here, two TFT(s) are formed in a pixel. TFT (henceforth TFT for switching) on which 201 functions as a component for switching, and 202 are TFT(s) (henceforth TFT for current control) which function as a component for current control which controls the amount of currents passed to an EL element, and are formed by both with the n channel mold TFT.
[0018] For the electric field effect mobility of the n channel mold TFT, since it is larger than the electric field effect mobility of the p channel mold TFT, a working speed is a sink and a cone about a high current early. Moreover, TFT size can do the direction of the n channel mold TFT small also passing the same amount of currents. Therefore, since the direction which used the n channel mold TFT as TFT for current control becomes large, its effective area of a display is desirable.
[0019] Hot carrier impregnation hardly becomes a problem, but the p channel mold TFT has

the advantage that an OFF state current value is low, and the example used as TFT for switching and the example used as TFT for current control are already reported. However, in this invention, also in the n channel mold TFT, the problem of hot carrier impregnation and the problem of an OFF state current value are solved by considering as the structure where the location of a LDD field was changed, and the description is that it is using all TFT(s) in all pixels as the n channel mold TFT.

[0020] However, in this invention, it is also possible for it not to be necessary to limit TFT for switching and TFT for current control to the n channel mold TFT, and to use the p channel mold TFT for both or either one of the two.

[0021] TFT201 for switching has the drain wiring 22 in a barrier layer including the source field 13, the drain field 14, the LDD fields 15a-15d, the high concentration impurity range 16, and the channel formation fields 17a and 17b, gate dielectric film 18, the gate electrodes 19a and 19b, the 1st interlayer insulation film 20, and source wiring 21 list, and is formed in them.

[0022] Moreover, as shown in drawing 2 , the gate electrodes 19a and 19b have double-gate structure electrically connected by the gate wiring 211 formed with another ingredient (gate electrodes 19a and 19b low ingredient [****]). Of course, you may be the so-called multi-gate structures (structure containing the barrier layer which has two or more channel formation fields connected to the serial), such as not only double-gate structure but triple gate structure. Multi-gate structure is very effective when reducing an OFF state current value, and in this invention, low TFT for switching of an OFF state current value is realized by making TFT201 for switching of a pixel into multi-gate structure.

[0023] Moreover, a barrier layer is formed by the semi-conductor film including the crystal structure. That is, the single crystal semiconductor film is sufficient and the polycrystal semi-conductor film and the microcrystal semi-conductor film are sufficient. Moreover, what is necessary is just to form gate dielectric film 18 by the insulator layer containing silicon. Moreover, all electric conduction film can be used as a gate electrode, source wiring, or drain wiring.

[0024] Furthermore, in TFT201 for switching, the LDD fields 15a-15d are formed so that it may not lap with the gate electrodes 17a and 17b on both sides of gate dielectric film 18. Such structure is very effective when reducing an OFF state current value.

[0025] In addition, it is still more desirable to prepare an offset field (field where it becomes in the semi-conductor layer of the same presentation as a channel formation field, and gate voltage is not impressed) between a channel formation field and a LDD field, when lowering an OFF state current value. Moreover, in the case of the multi-gate structure of having two or more gate electrodes, the high concentration impurity range prepared between channel formation fields is effective for reduction of an OFF state current value.

[0026] As mentioned above, a switching element with a fully low OFF state current value is realizable by using TFT of multi-gate structure as TFT201 for switching of a pixel. Therefore, even if it does not form a capacitor like drawing 2 of JP,10-189252,A, the gate voltage of TFT for [sufficient] time amount (after being chosen until it is chosen as degree) current control can be maintained.

[0027] That is, it becomes possible to eliminate conventionally the capacitor used as the factor which narrows effective luminescence area, and it becomes possible to make effective luminescence area large. This means that image quality of EL display can be made bright.

[0028] Next, TFT202 for current control has the drain wiring 37 in a barrier layer including the source field 31, the drain field 32, the LDD field 33, and the channel formation field 34, gate dielectric film 18, the gate electrode 35, the 1st interlayer insulation film 20, and source wiring 36 list, and is formed in them. In addition, although the gate electrode 35 has single gate structure, you may be multi-gate structure.

[0029] As shown in drawing 2 , the drain of TFT201 for switching is electrically connected to the gate of TFT202 for current control. Specifically, the gate electrode 35 of TFT202 for current control is electrically connected through the drain field 14 of TFT201 for switching, and the drain wiring (said to be connection wiring) 22. Moreover, source wiring 36 is connected to the current supply source line 212.

[0030] The description of this TFT202 for current control is the point that channel width is larger than the channel width of TFT201 for switching. That is, as shown in drawing 8 , when channel length of TFT for switching was set to L1, channel width was set to W1, channel length of TFT for current control is set to L2 and channel width is set to W2, it is made for relational expression called W2/L2 >=5xW1/L1 (preferably W2/L2>=10x W1/L1) to be realized. For this reason, it is possible to pass many currents easily rather than TFT for switching.
[0031] In addition, channel length L1 of TFT for switching which is multi-gate structure is taken as total of each channel length of two or more formed channel formation fields. Since it is double-gate structure in the case of drawing 8 , what added each channel length L1a and L1b of two channel formation fields serves as the channel length L1 of TFT for switching.
[0032] In this invention, although channel length L1 and L2 and channel width W1 and W2 are not limited to the specific numerical range, it is desirable that W1 sets to 0.1-5 micrometers (typically 1-3 micrometers), and W2 sets to 0.5-30 micrometers (typically 2-10 micrometers). At this time, it is desirable that L1 sets to 0.2-18 micrometers (typically 2-15 micrometers), and L2 sets to 0.1-50 micrometers (typically 1-20 micrometers).
[0033] In addition, in TFT for current control, in order to prevent that a current flows superfluously, it is desirable to set up the die length of channel length L for a long time. It is good to be preferably referred to as W2/L2 >=3 (preferably W2/L 2>=5). It is made to be desirably set to 0.5-2microper 1 pixel of ** A (preferably 1-1.5microA).
[0034] Even EL indicating equipment which has the number of pixels of a Hi-Vision class (1920x1080 or 1280x1024) from EL indicating equipment which has the number of pixels of a VGA class (640x480) can cover all specification by considering as these numerical range.
[0035] Moreover, what is necessary is just to set typically to 2.0-2.5 micrometers the 0.5-3.5 micrometers (width of face) of the die length of the LDD field formed in TFT201 for switching.
[0036] Moreover, EL indicating equipment shown in drawing 1 has the description also in the point of having the field where the LDD field 33 was formed between the drain field 32 and the channel formation field 34, and the LDD field 33 has lapped with the gate electrode 35 on both sides of gate dielectric film 18, and the field with which it has not lapped, in TFT202 for current control.
[0037] TFT202 for current control controls the amount of supply, and enables a gradation display at the same time it supplies the current for making EL element 203 emit light. Therefore, it is necessary to take the cure against degradation by hot carrier impregnation so that it may not deteriorate, even if it passes a current. Moreover, in case black is displayed, TFT202 for current control is made into the OFF state, but in that case, if an OFF state current value is high, a beautiful black display will become impossible and the fall of contrast etc. will be caused. Therefore, it is necessary to also hold down an OFF state current value.
[0038] About degradation by hot carrier impregnation, it is known that the structure with which the LDD field lapped to the gate electrode is very effective. However, since an OFF state current value will increase if the whole LDD field is kept in a gate electrode in piles, these people have solved the cure against a hot carrier, and the cure against an OFF state current value to coincidence according to the new structure of establishing the LDD field which does not lap with a gate electrode in a serial.
[0039] What is necessary is just to set to 0.1-3 micrometers (preferably 0.3-1.5 micrometers) the die length of the LDD field which lapped with the gate electrode at this time. If too long, parasitic capacitance is enlarged, and if too short, the effectiveness of preventing a hot carrier will become weak. Moreover, what is necessary is just to set to 1.0-3.5 micrometers (preferably 1.5-2.0 micrometers) the die length of the LDD field which does not lap with a gate electrode. When too long, it becomes impossible to pass sufficient current, and if too short, the effectiveness of reducing an OFF state current value will become weak.
[0040] Moreover, it is more desirable not to prepare between the source field 31 and the channel formation field 34, since parasitic capacitance will be formed in the field with which the gate electrode and the LDD field lapped in the above-mentioned structure. Since TFT for current control always has the same direction where a carrier (here electron) flows, it is enough if the LDD field is established only in the drain field side.

[0041] Moreover, if the amount of currents which can be passed is seen from a viewpoint of making [many] it, what thickness of the barrier layer (especially channel formation field) of TFT202 for current control is thickened also for (preferably 50-100nm, still more preferably 60-80nm) is effective. On the contrary, in TFT201 for switching, if an OFF state current value is seen from a viewpoint of making it small, what thickness of a barrier layer (especially channel formation field) is made thin also for (preferably 20-50nm, still more preferably 25-40nm) is effective.
[0042] 41 [next,] -- the 1st passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good. As an ingredient, the insulator layer (the nitriding oxidation silicon film or a silicon nitride film is especially desirable) containing silicon can be used. This passivation film 41 has the role which protects formed TFT from alkali metal or moisture. Alkali metal, such as sodium, is contained in EL layer finally prepared above TFT. That is, the 1st passivation film 41 works also as a protective layer which does not make such alkali metal (movable ion) invade into the TFT side.
[0043] Moreover, it is also effective to prevent the heat deterioration of EL layer by giving the heat dissipation effectiveness to the 1st passivation film 41. However, since, as for EL indicating equipment of the structure of drawing 1 , light is emitted to a substrate 11 side, the 1st passivation film 41 needs to have translucency. Moreover, since it deteriorates by association with oxygen when using an organic material as an EL layer, as for the insulator layer which is easy to emit oxygen, not using is desirable.
[0044] The insulator layer which contains at least one element chosen from B (boron), C (carbon), and N (nitrogen) and at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn) as a translucency ingredient with the heat dissipation effectiveness (thermal conductivity is high) is mentioned. For example, it is possible to use the nitride of the aluminum represented by alumimium nitride (AlxNy), the carbide of the silicon represented by silicon carbide (SixCy), the nitride of the silicon represented by silicon nitride (SixNy), the nitride of the boron represented by boron nitride (BxNy), and the phosphide of the boron represented by boron phosphide (BxPy). Moreover, the oxide of the aluminum represented by the aluminum oxide (AlxOy) is excellent in translucency, and thermal conductivity is 20Wm-1K-1, and it can be said to be one of the desirable ingredients. There is not only the heat dissipation effectiveness but effectiveness which prevents invasion of moisture, alkali metal, etc. in these ingredients. In addition, in the above-mentioned translucency ingredient, x and y are the integers of arbitration.
[0045] In addition, other elements are also combinable with the above-mentioned compound. For example, it is also possible to add nitrogen to an aluminum oxide and to use the nitriding aluminum oxide shown by AlNxOy. There is effectiveness which prevents invasion of not only the heat dissipation effectiveness but moisture, alkali metal, etc. also in this ingredient. In addition, in the above-mentioned nitriding aluminum oxide, x and y are the integers of arbitration.
[0046] Moreover, the ingredient indicated by JP,62-90260,A can be used. that is, the insulator layer (however, M -- rare earth elements -- at least -- a kind and at least one element preferably chosen from Ce (cerium), Yb (ytterbium), Sm (samarium), Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium)) containing Si, aluminum, N, O, and M can also be used. There is effectiveness which prevents invasion of not only the heat dissipation effectiveness but moisture, alkali metal, etc. also in these ingredients.
[0047] Moreover, the carbon film which contains at least a diamond thin film or the amorphous carbon film (especially the thing that has a near property is called diamond-like carbon to a diamond.) can also be used. These have very high thermal conductivity and are very effective as a heat dissipation layer. However, since brown will be worn and permeability will fall if thickness becomes thick, it is desirable to use by as thin thickness (preferably 5-100nm) as possible.
[0048] In addition, since it is in the purpose of the 1st passivation film 41 protecting TFT from alkali metal or moisture to the last, don't spoil the effectiveness. Therefore, although the thin film which consists of an ingredient with the above-mentioned heat dissipation effectiveness

can also be used alone, it is effective to carry out the laminating of these thin films and the thin film (typically a silicon nitride film (SixNy) and nitriding oxidation silicon film (SiOxNy)) which has the property which intercepts alkali metal and moisture. In addition, in the above-mentioned silicon nitride film or the nitriding oxidation silicon film, x and y are the integers of arbitration.

[0049] Moreover, 42 is a color filter and 43 is a fluorescent substance (it is also called a fluorescence pigment layer). In the combination of the same color, both contain the coloring matter of red (R), green (G), or blue (B). It prepares, in order that a color filter 42 may raise color purity, and a fluorescent substance 43 is formed in order to perform color conversion.

[0050] In addition, the method which combined the method which it roughly divides into EL display, and there are four colorization means of displaying, and forms three kinds of EL elements corresponding to RGB, the method which combined the EL element and color filter of white luminescence, blue, or the EL element and fluorescent substance (the color conversion layer of fluorescence: CCM) of bluish green luminescence, the method which puts the EL element corresponding to RGB on cathode (counterelectrode) using a transparent electrode, ******.

[0051] The structure of drawing 1 is an example at the time of using the method which combined the EL element and fluorescent substance of blue luminescence. Here, light with the wavelength of the blue field which contains ultraviolet radiation, using the luminous layer of blue luminescence as EL element 203 is formed, by the light, a fluorescent substance 43 is excited and the light of red, green, or blue is generated. And color purity is raised and outputted with a color filter 42.

[0052] However, it is not concerned with a luminescence method, but this invention can be carried out, and can use all the four above-mentioned methods for this invention.

[0053] Moreover, after forming a color filter 42 and a fluorescent substance 43, the 2nd interlayer insulation film 44 performs flattening. As the 2nd interlayer insulation film 44, the resin film is desirable and it is good to use polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. Of course, the inorganic film may be used as long as sufficient flattening is possible.

[0054] It is very important to carry out flattening of the level difference by TFT with the 2nd interlayer insulation film 44. Since EL layer formed behind is very thin, poor luminescence may be caused when a level difference exists. Therefore, before forming a pixel electrode so that EL layer can be formed as much as possible in a flat side, it is desirable to carry out flattening.

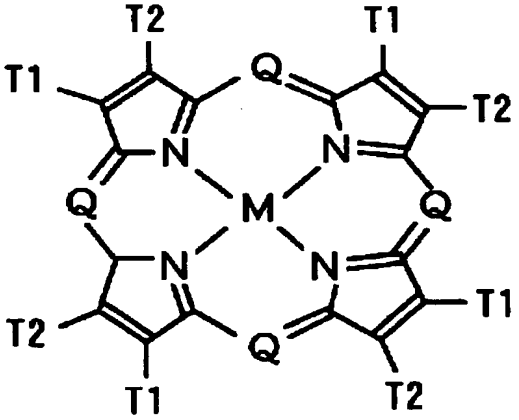
[0055] Moreover, 45 is the 2nd passivation film (the implications as a heat dissipation layer are strong), and 5nm - 1 micrometer (typically 20-300nm) of thickness is desirable. It functions as this 2nd passivation film 45 being formed in contact with an EL element, missing the heat generated in the EL element, and heat not accumulating it in an EL element. Moreover, since it is weak with heat when the 2nd interlayer insulation film 44 is resin film, it is made for the heat generated in the EL element not to have a bad influence on the 2nd interlayer insulation film 44.

[0056] In producing EL display as mentioned above, it was effective to have carried out flattening of the TFT by the resin film, but the structure in consideration of degradation of the resin film by the heat generated in the EL element did not have the former. In this invention, the point which has solved the point can also be said to be one of the descriptions by forming the 2nd passivation film 45.

[0057] Moreover, the 2nd passivation film 45 functions also as a protective layer for making it the alkali metal in EL layer not spread to the TFT side, and functions also as a protective layer by which it is made for neither moisture nor oxygen to invade into EL layer side from the TFT side further at the same time it prevents degradation by the above-mentioned heat.

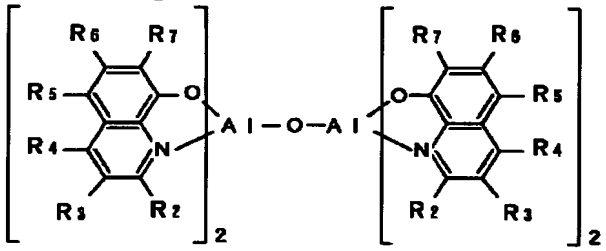
[0058] The ingredient same as an ingredient of this 2nd passivation film 45 as the ingredient which can be used for the 1st passivation film 41 can be used. As a high ingredient of especially the heat dissipation effectiveness, carbon films, such as diamond film or diamond-like carbon film, are desirable, and in order to prevent invasion of moisture etc., it is still more

desirable to use the laminated structure of a carbon film and a silicon nitride film (or nitriding oxidation silicon film).
[0059] Thus, it can be said that the point of the heat dissipation effectiveness being high in a TFT and EL element side, and dissociating by the insulator layer which can intercept moisture and alkali metal is one of the important descriptions of this invention, and is the configuration which is not in the conventional EL display.
[0060] Moreover, 46 is a pixel electrode (anode plate of an EL element) which becomes by the transparence electric conduction film, and after it opens a contact hole in the 2nd passivation film 45, the 2nd interlayer insulation film 44, and the 1st passivation film 41, it is formed so that it may connect with the drain wiring 37 of TFT202 for current control.
[0061] On the pixel electrode 46, the EL layer (an organic material is desirable) 47, cathode 48, and the protection electrode 49 are formed one by one. Although the EL layer 47 is used by the monolayer or the laminated structure, it is used by the laminated structure in many cases. Although various laminated structures are proposed combining a luminous layer, the electronic transportation layer, the electron injection layer, the hole-injection layer, or the electron hole transportation layer, in this invention, you may be which structure. Of course, fluorescence coloring matter etc. may be doped to EL layer. Moreover, in this specification, the light emitting device formed in a pixel electrode (anode plate), EL layer, and cathode is called an EL element.
[0062] In this invention, all well-known EL ingredients can already be used. When the organic material is known widely and driver voltage is taken into consideration as a well-known ingredient, it is desirable to use an organic material. As an organic electroluminescence ingredient, the ingredient indicated by the following United States patents or open official reports can be used, for example.
[0063] U.S. Pat. No. 4,356,429 U.S. Pat. No. 4,539,507, U.S. Pat. No. 4,720,432 U.S. Pat. No. 4,769,292, U.S. Pat. No. 4,885,211 U.S. Pat. No. 4,950,950, U.S. Pat. No. 5,059,861 U.S. Pat. No. 5,047,687, U.S. Pat. No. 5,073,446 U.S. Pat. No. 5,059,862, U.S. Pat. No. 5,061,617 U.S. Pat. No. 5,151,629 U.S. Pat. No. 5,294,869 U.S. Pat. No. 5,294,870, JP,10-189252,A, JP,8-241048,A, JP,8-78159,A.
[0064] Specifically, the organic material as a hole-injection layer can use what is expressed with the following general formulas.
[0065]
[Formula 1]

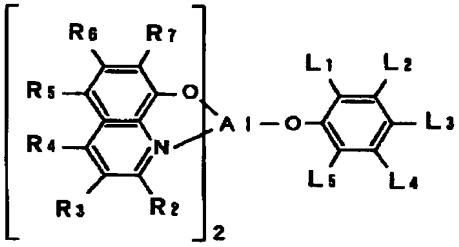


[0066] Q is N or C-R (chain) here, M is a metal, a metallic oxide, or a metal halogenide, R is hydrogen, alkyl, an aralkyl, an allyl compound, or Al Khalil, and T1 and T2 are the partial saturation six membered rings containing hydrogen, alkyl, or a substituent like a halogen.
[0067] Moreover, the organic material as an electron hole transportation layer can use an aromatic series tertiary amine, and contains the tetra-allyl compound diamine preferably expressed with the following general formulas.
[0068]
[Formula 2]

[0069] Are is a propine group here, n is the integer of 1 to 4, and Ar, R7, R8, and R9 are the selected allyl compound groups, respectively.
[0070] Moreover, the organic material as EL layer, an electronic transportation layer, or an electron injection layer can use a metal oxy-NOIDO compound. What is necessary is just to use what is expressed with the following general formulas as a metal oxy-NOIDO compound.
[0071]
[Formula 3]

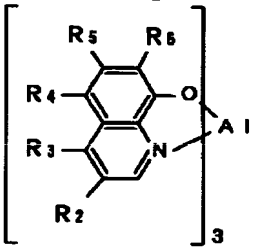


[0072] R2-R7 can be replaced and they can also use the following metal oxy-NOIDO compounds here.
[0073]
[Formula 4]



[0074] R2-R7 are based on an above-mentioned definition here, and L1-L5 are a carbohydrate group containing the carbon element of 1 to 12, and both L1 and L2, and L2 and L3 can form a benzo ring. Moreover, the following metal oxy-NOIDO compounds are sufficient.

[0075]
[Formula 5]



[0076] R2-R6 can be replaced here. Thus, the coordination compound which has organic ligand as an organic electroluminescence ingredient is included. However, the above example is an example of the organic electroluminescence ingredient which can be used as an EL ingredient of this invention, and there is no need of limiting to this.
[0077] Moreover, when using an ink jet method as the formation approach of EL layer, as an EL ingredient, a polymer system ingredient is desirable. As a typical polymer system ingredient, polymeric materials, such as a poly para-phenylene vinylene (PPV) system and the poly fluorene system, are mentioned. In order to colorize, to red luminescent material,

polyphenylene vinylene and the poly alkyl phenylene are [cyano polyphenylene vinylene and green luminescent material / polyphenylene vinylene and blue luminescent material] desirable. All the ingredients indicated by JP,10-012377,A can be quoted about the organic electroluminescence ingredient which can be used for the ink jet method.
[0078] Moreover, the ingredient which contains the small magnesium (Mg), the lithium (Li), the caesium (Cs), the barium (Ba), the potassium (K), beryllium (Be), or calcium (calcium) of a work function as cathode 48 is used. What is necessary is just to use the electrode which becomes preferably by MgAg (ingredient which mixed Mg and aluminum by Mg:Ag=10:1). A MgAgAl electrode, a LiAl electrode, and a LiFAl electrode are mentioned to others. Moreover, it is the electrode prepared in order that the protection electrode 49 may carry out the protective coat of the cathode 48 from external moisture etc., and the ingredient containing aluminum (aluminum) or silver (Ag) is used. There is the heat dissipation effectiveness in this protection electrode 49.
[0079] In addition, as for the EL layer 47 and cathode 48, it is desirable to carry out continuation formation, without carrying out atmospheric-air release. Namely, no matter EL layer and cathode may be what laminated structures, it is desirable to carry out continuation formation altogether with the membrane formation equipment of a multi chamber (it is also called cluster tool) method. When using an organic material as an EL layer, since it is very weak for moisture, this is for avoiding the moisture absorption when carrying out atmospheric-air release. Furthermore, even the EL layer 47 and not only the cathode 48 but the protection electrode 49 on it is still better to carry out continuation formation.
[0080] Although vacuum evaporation technique (especially organic molecular-beam vacuum deposition is effective when forming the super-thin film of molecule order level.), a spatter, a plasma-CVD method, a spin coating method, screen-stencil, or the ion plating method has desirable EL layer to heat as the membrane formation approach since it is very weak, forming by the ink jet method is also possible. Although there are Bubble Jet (JP,5-116297,A etc.) which uses cavitation, and piezo methods (JP,8-290647,A etc.) using a piezo-electric element as ink jet method, a piezo method is desirable if an organic electroluminescence ingredient takes an example by heat in a weak thing.
[0081] 50 [moreover,] -- the 3rd passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good. Although the purpose which forms the 3rd passivation film 50 has the main purpose which protects the EL layer 47 from moisture, it may give the heat dissipation effectiveness like the 2nd passivation film 45. Therefore, the thing same as a formation ingredient as the 1st passivation film 41 can be used. However, since it may deteriorate by association with oxygen when using an organic material as an EL layer 47, as for the insulator layer which is easy to emit oxygen, not using is desirable.
[0082] Moreover, since EL layer is weak with heat as mentioned above, it is desirable to form membranes if possible at low temperature (preferably temperature requirement from a room temperature to 120 degrees C). Therefore, it can be said to be the membrane formation approach that a plasma-CVD method, a spatter, vacuum evaporation technique, the ion plating method, or the solution applying method (spin coating method) is desirable.
[0083] Thus, although forming the 2nd passivation film 45 can also fully control degradation of an EL element, an EL element is surrounded still more preferably by the insulator layer of the bilayer formed on both sides of the EL element like the 2nd passivation film 45 and the 3rd passivation film 50, invasion of the moisture to EL layer and oxygen is prevented, diffusion of the alkali metal from EL layer is prevented, and are recording of the heat to EL layer is prevented. Consequently, degradation of EL layer is controlled further and reliable EL display is obtained.
[0084] Moreover, EL display of this invention has the pixel section which consists of a pixel of structure like drawing 1 , and TFT from which structure differs according to a function in a pixel is arranged. TFT for switching of an OFF state current value low enough and TFT for current control strong against hot carrier impregnation can form in the same pixel by this, it has high dependability and EL display in which good image display is possible (the engine performance of operation is high) is obtained.

[0085] In addition, although TFT of multi-gate structure is used as TFT for switching in the pixel structure of drawing 1 , it is not necessary to limit to the configuration of drawing 1 about the configuration of arrangement of a LDD field etc.
[0086] Suppose that still more detailed explanation is given about this invention which becomes with the above configuration as it is also at the example shown below.
[0087] [Example 1] The example of this invention is explained using drawing 3 - drawing 5 . Here, how to produce to coincidence TFT of the pixel section and the drive circuit section prepared around it is explained. However, in order to simplify explanation, suppose that the CMOS circuit which is a basic circuit is illustrated about a drive circuit.
[0088] First, as shown in drawing 3 (A), the substrate film 301 is formed on a glass substrate 300 at the thickness of 300nm. In this example, as substrate film 301, the laminating of the nitriding oxidation silicon film is carried out, and it is used. At this time, it is good to make into 10 - 25wt% nitrogen concentration of the direction which touches a glass substrate 300.
[0089] Moreover, it is effective to prepare the insulator layer which consists of the ingredient same as some substrate film 301 as the 1st passivation film 41 shown in drawing 1 . It is effective to prepare the insulator layer which is easy to generate heat since TFT for current control will pass a high current, and has the heat dissipation effectiveness in as near a place as possible.
[0090] Next, the amorphous silicon film (not shown) with a thickness of 50nm is formed by the well-known forming-membranes method on the substrate film 301. In addition, what is necessary is just the semi-conductor film (the microcrystal semi-conductor film is included) which does not need to limit to the amorphous silicon film and includes amorphous structure. The compound semiconductor film which furthermore includes the amorphous structure of the amorphous silicon germanium film etc. is sufficient. Moreover, thickness should just be 20-100nm in thickness.
[0091] And the amorphous silicon film is crystallized with a well-known technique, and the crystalline substance silicon film (it is also called the polycrystalline silicon film or the polish recon film) 302 is formed. As the well-known crystallization approach, there are the heat crystallization approach which used the electric heat furnace, a laser annealing crystallizing method using laser light, and the lamp annealing crystallizing method using infrared light. In this example, it crystallizes using the excimer laser light which used XeCl gas.
[0092] In addition, although the excimer laser light of the pulse oscillation mold processed into the line is used in this example, you may be a rectangle and the argon laser light of a continuous-oscillation mold and the excimer laser light of a continuous-oscillation mold can also be used.
[0093] Although the crystalline substance silicon film is used as a barrier layer of TFT in this example, it is also possible to use the amorphous silicon film. However, it is more advantageous to use a sink and the cone crystalline substance silicon film for a current, since TFT for current control has the need of passing a high current.
[0094] In addition, it is effective to form the barrier layer of TFT for switching with the need of reducing the OFF state current, by the amorphous silicon film, and to form the barrier layer of TFT for current control by the crystalline substance silicon film. Since the amorphous silicon film has low carrier mobility, the OFF state current cannot flow easily that it is hard to pass a current. That is, the advantage of both sink or cone crystalline substance silicon film can be efficiently employed [a current] for the pile amorphous silicon film and a current in a sink.
[0095] Next, as shown in drawing 3 (B), the protective coat 303 which becomes by the oxidation silicon film is formed on the crystalline substance silicon film 302 at the thickness of 130nm. What is necessary is just to choose this thickness in 100-200nm (preferably 130-170nm). Moreover, other film is sufficient as long as it is an insulator layer containing silicon. This protective coat 303 is formed in order to enable concentration control delicate in order not to put the crystalline substance silicon film to the direct plasma, in case an impurity is added.
[0096] And the resist masks 304a and 304b are formed on it, and the impurity element

(henceforth n mold impurity element) which gives n mold through a protective coat 303 is added. In addition, Lynn or arsenic can be used for the element and type target which belong to 15 groups typically as an n mold impurity element. In addition, in this example, Lynn is added by the concentration of 1x1018 atoms/cm3 using the plasma doping method which carried out plasma excitation without carrying out mass separation of the phosphoretted hydrogen (PH3). Of course, the ion implantation method for performing mass separation may be used.

[0097] In n mold impurity ranges 305 and 306 formed of this process, a dose is adjusted so that n mold impurity element may be contained by the concentration of 2x1016 - 5x1019 atoms/cm3 (typically 5x1017 - 5x1018 atoms/cm3).

[0098] Next, as shown in drawing 3 (C), the element which removes a protective coat 303 and belongs to 15 groups who added is activated. Although an activation means should just use a well-known technique, it is activated by the exposure of excimer laser light by this example. Of course, a pulse oscillation mold or a continuous-oscillation mold may be used, and it is not necessary to limit to excimer laser light. However, since activation of the added impurity element is the purpose, it is desirable to irradiate with the energy which is extent which the crystalline substance silicon film does not fuse. In addition, laser light may be irradiated, with the protective coat 303 attached.

[0099] In addition, activation by heat treatment may be used together on the occasion of activation of the impurity element by this laser light. What is necessary is just to perform heat treatment of about 450-550 degrees C in consideration of the thermal resistance of a substrate, when performing activation by heat treatment.

[0100] The boundary section (joint) with the field which has not added n mold impurity element which exists in the edge of n mold impurity ranges 305 and 306, i.e., the perimeter of n mold impurity ranges 305 and 306, according to this process becomes clear. This means that a LDD field and a channel formation field can form a very good joint, when TFT is completed behind.

[0101] Next, as shown in drawing 3 (D), the unnecessary part of the crystalline substance silicon film is removed, and the island-like semi-conductor film (henceforth a barrier layer) 307-310 is formed.

[0102] Next, as shown in drawing 3 (E), barrier layers 307-310 are covered and gate dielectric film 311 is formed. What is necessary is just to use 10-200nm of insulator layers which contain silicon with a thickness of 50-150nm preferably as gate dielectric film 311. Monolayer structure or a laminated structure is sufficient as this. In this example, the nitriding oxidation silicon film of 110nm thickness is used.

[0103] Next, patterning of the electric conduction film of 200-400nm thickness is formed and carried out, and the gate electrodes 312-316 are formed. In addition, in this example, a gate electrode and wiring for leading about electrically connected to the gate electrode (henceforth gate wiring) are formed with another ingredient. concrete -- a gate electrode -- low -- an ingredient [****] is used as gate wiring. Even if micro processing of this is impossible for gate wiring using the ingredient in which micro processing is possible as a gate electrode, it is for wiring resistance to use a small ingredient. Of course, a gate electrode and gate wiring may be formed with the same ingredient.

[0104] Moreover, although a gate electrode may be formed by the electric conduction film of a monolayer, it is desirable to consider as cascade screens, such as a bilayer and three layers, if needed. All electric conduction film well-known as an ingredient of a gate electrode can be used. However, the ingredient in which patterning is possible in line breadth of 2 micrometers or less is possible [micro processing] as mentioned above and specifically desirable.

[0105] Typically A tantalum (Ta), titanium (Ti), molybdenum (Mo), The film which becomes by the element chosen from a tungsten (W) or chromium (Cr), or the nitride film (typical -- the tantalum nitride film and the nitriding tungsten film --) of said element The silicon film which gave the titanium nitride film, the alloy film (typically a Mo-W alloy, a Mo-Ta alloy) which combined said element, the silicide film (typically tungsten silicide film, titanium silicide film) of

said element, or conductivity can be used. Of course, it may use by the monolayer, or a laminating may be carried out and you may use.
[0106] In this example, the cascade screen which becomes by the tantalum nitride (TaN) film of 50nm thickness and Ta film of 350nm thickness is used. What is necessary is just to form this by the spatter. Moreover, if inert gas, such as Xe and Ne, is added as sputtering gas, film peeling by stress can be prevented.
[0107] Moreover, at this time, the gate electrodes 313 and 316 are formed so that it may lap through gate dielectric film 311 with a part of n mold impurity ranges 305 and 306, respectively. This overlapping part serves as a LDD field which lapped with the gate electrode behind.
[0108] Next, as shown in drawing 4 (A), n mold impurity element (this example Lynn) is added in self align by using the gate electrodes 312-316 as a mask. In this way, in the impurity ranges 317-323 formed, it adjusts so that Lynn may be added by the concentration of 1 / 2 - 1/10 of n mold impurity ranges 305 and 306 (typically 1 / 3 - 1/4). Specifically, the concentration of 1x1016 - 5x1018 atoms/cm3 (typically 3x1017 - 3x1018 atoms/cm3) is desirable.
[0109] Next, as shown in drawing 4 (B), the resist masks 324a-324d are formed for a gate electrode etc. in a wrap form, and the impurity ranges 325-331 which add n mold impurity element (this example Lynn), and include Lynn in high concentration are formed. It carries out by the ion doping method for having used phosphoretted hydrogen (PH3) also here, and the concentration of Lynn of this field is adjusted so that it may become 1x1020 - 1x1021 atoms/cm3 (typically 2x1020 - 5x1020 atoms/cm3).
[0110] Although the source field or drain field of the n channel mold TFT is formed of this process, in TFT for switching, it leaves a part of n mold impurity ranges 320-322 formed at the process of drawing 4 (A). This left-behind field is equivalent to the LDD fields 15a-15d of TFT for switching in drawing 1 .
[0111] Next, as shown in drawing 4 (C), the resist masks 324a-324d are removed, and the resist mask 332 is newly formed. And p mold impurity element (this example boron) is added, and the impurity ranges 333 and 334 which contain boron in high concentration are formed. Here, boron is added so that it may become 3x1020 - 3x1021 atoms/cm3 (typically 5x1020 - 1x1021 atoms/cm3) concentration by the ion doping method for having used diboron hexahydride (B-2 H6).
[0112] In addition, although Lynn is already added by impurity ranges 333 and 334 by the concentration of 1x1016 - 5x1018 atoms/cm3, the boron added here is added by the concentration of at least 3 times or more. Therefore, it is completely reversed to P type, and the impurity range of n mold currently formed beforehand functions as an impurity range of P type.
[0113] Next, after removing the resist mask 332, n mold or p mold impurity element added by each concentration is activated. As an activation means, it can carry out by the furnace annealing method, the laser annealing method, or the lamp annealing method. In this example, 550 degrees C and heat treatment of 4 hours are performed among nitrogen-gas-atmosphere mind in an electric heat furnace.
[0114] It is important to eliminate the oxygen in an ambient atmosphere as much as possible at this time. It is because it is hard coming to take ohmic contact behind while the front face of the gate electrode exposed when oxygen existed oxidizes and causing the increment in resistance. Therefore, as for the oxygen density in the processing ambient atmosphere in the above-mentioned activation process, it is preferably desirable to be referred to as 0.1 ppm or less 1 ppm or less.
[0115] Next, if an activation process is completed, the gate wiring 335 of 300nm thickness will be formed. What is necessary is just to use the metal membrane which uses aluminum (aluminum) or copper (Cu) as a principal component (it considers as a presentation and 50 - 100% is occupied.) as an ingredient of the gate wiring 335. Like the gate wiring 211 of drawing 2 as arrangement, it forms so that the gate electrodes 314 and 315 (it is equivalent to the gate electrodes 19a and 19b of drawing 2) of TFT for switching may be connected

electrically. (Drawing 4 (D))
[0116] Since wiring resistance of gate wiring can be made very small by considering as such structure, the image display field (pixel section) where area is large can be formed. That is, when the magnitude of a screen realizes EL display of 10 inches or more (30 more inches or more) of vertical angles, the pixel structure of this example is very effective.
[0117] Next, as shown in drawing 5 (A), the 1st interlayer insulation film 336 is formed. What is necessary is just to use the cascade screen which used the insulator layer containing silicon by the monolayer as the 1st interlayer insulation film 336, or was combined in it. Moreover, thickness is just 400nm - 1.5 micrometers. In this example, it considers as the structure which carried out the laminating of the oxidation silicon film of 800nm thickness on the nitriding oxidation silicon film of 200nm thickness.
[0118] Furthermore, in the ambient atmosphere containing 3 - 100% of hydrogen, heat treatment of 1 - 12 hours is performed at 300-450 degrees C, and a hydrogen treating is performed. This process is a process which carries out hydrogen termination of the azygos joint hand of the semi-conductor film by the hydrogen excited thermally. As other means of hydrogenation, plasma hydrogenation (the hydrogen excited by the plasma is used) may be performed.
[0119] In addition, a hydrogen treating may be put in while forming the 1st interlayer insulation film 336. That is, after forming the nitriding oxidation silicon film of 200nm thickness, a hydrogen treating may be performed as mentioned above, and it may remain after that, and the oxidation silicon film of 800nm thickness may be formed.
[0120] Next, a contact hole is formed to the 1st interlayer insulation film 336, and source wiring 337-340 and the drain wiring 341-343 are formed. In addition, in this example, it considers as the cascade screen of the three-tiered structure which carried out the aluminum film which contains [this electrode] 100nm and titanium for the titanium film by 300nm, and carried out continuation formation of the 150nm of the titanium film by the spatter. Of course, other electric conduction film is sufficient and the alloy film containing silver, palladium, and copper may be used.
[0121] Next, the 1st passivation film 344 is formed by the thickness of 50-500nm (typically 200-300nm). In this example, the nitriding oxidation silicon film of 300nm thickness is used as the 1st passivation film 344. A silicon nitride film may be substituted for this. Of course, it is possible to use the same ingredient as the 1st passivation film 41 of drawing 1 .
[0122] In addition, it is effective to perform plasma treatment using the gas which contains H2 and NH3 grade hydrogen in advance of formation of the nitriding oxidation silicon film. The membraneous quality of the 1st passivation film 344 is improved because the hydrogen excited by this pretreatment heat-treats by supplying the 1st interlayer insulation film 336. Since the hydrogen added by the 1st interlayer insulation film 336 at it and coincidence is spread in a lower layer side, a barrier layer can be hydrogenated effectively.
[0123] Next, as shown in drawing 5 (B), a color filter 345 and a fluorescent substance 346 are formed. These ingredients should just use a well-known thing. Moreover, patterning may be carried out separately and you may form, and these are formed continuously, and by package, patterning of them may be carried out and they may be formed. Moreover, what is necessary is just to use screen printing, the ink jet method, mask vacuum deposition (how to form alternatively using mask material), etc. as the formation approach.
[0124] Each thickness is chosen in 0.5-5 micrometers (typically 1-2 micrometers). The optimal thickness changes with ingredients which use especially the fluorescent substance 346. That is, if too thin, color conversion efficiency will worsen, if too thick, a level difference turns large up and the amount of transmitted lights of light will fall off. Therefore, the optimal thickness must be determined on the balance of both properties.
[0125] In addition, although this example explains the light generated from EL layer taking the case of the colorization method which carries out color conversion, when adopting the method which produces EL layer corresponding to RGB according to an individual, a color filter and a fluorescent substance can also be omitted.
[0126] Next, the 2nd interlayer insulation film 347 which consists of resin is formed. As resin,

polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. can be used. Since especially the 2nd interlayer insulation film 347 has the strong implications of flattening, its acrylic excellent in surface smoothness is desirable. At this example, the acrylic film is formed by the thickness which can fully carry out flattening of the level difference of a color filter 345 and a fluorescent substance 346. desirable — 1-5 micrometers (still more preferably 2-4 micrometers) — then, it is good.

[0127] Next, the 2nd passivation film 348 of 100nm thickness is formed on the 2nd interlayer insulation film 347. In this example, the insulator layer containing Si, aluminum, N, O, and La is used. And the contact hole which reaches the drain wiring 343 is formed in the 2nd passivation film 348, the 2nd interlayer insulation film 347, and the 1st passivation film 344, and the pixel electrode 349 is formed. In this example, the compound (ITO) film of indium oxide and the tin oxide is formed in the thickness of 110nm, patterning is performed, and it considers as a pixel electrode. This pixel electrode 349 turns into an anode plate of an EL element. In addition, it is also possible to use the zinc-oxide film containing the compound film and oxidation gallium of indium oxide and a zinc oxide as other ingredients.

[0128] In addition, in this example, it has the structure where the pixel electrode 349 was electrically connected to the drain field 331 of TFT for current control through the drain wiring 343. There are the following advantages in this structure.

[0129] Since the pixel electrode 349 will touch organic materials, such as EL layer (luminous layer) and a charge transportation layer, directly, the movable ion contained in EL layer etc. may diffuse the inside of a pixel electrode. That is, the structure of this example cannot connect the pixel electrode 349 to the drain field 331 which is a part of direct barrier layer, but can prevent invasion of the movable ion to the inside of a barrier layer by relaying the drain wiring 343.

[0130] Next, continuation formation is carried out without carrying out atmospheric-air release of the EL layer 350, cathode (MgAg electrode) 351, and the protection electrode 352, as shown in drawing 5 (C). It is desirable to precede to form the EL layer 350 and cathode 351 at this time, to heat-treat to the pixel electrode 349, and to remove moisture completely. In addition, an ingredient well-known as an EL layer 350 can be used.

[0131] In addition, as an EL layer 350, it is [Embodiment of the Invention]. The ingredient explained by **** can be used. Although 4 layer structures which become in a hole-injection layer (Hole injecting layer), an electron hole transportation layer (Hole transporting layer), a luminous layer (Emitting layer), and an electronic transportation layer (Electron transporting layer) are used as EL layer in this example as shown in drawing 19 , an electronic transportation layer may not be prepared and an electron injection layer may be prepared. Moreover, a hole-injection layer may be omitted. Thus, various examples are already reported and combination may use which the configuration.

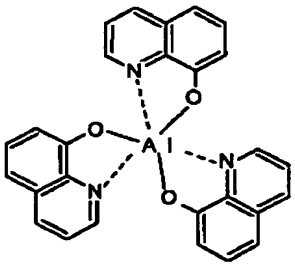
[0132] A hydrazone system (typically DEH), a stilbene system (typically STB), a star bust system (typically m-MTDATA), etc. can be used for others that what is necessary is just to use TPD (triphenylamine derivative) of an amine system as a hole-injection layer or an electron hole transportation layer. The star bust system ingredient which especially glass transition temperature cannot crystalize easily highly is desirable. Moreover, the poly aniline (PAni), the poly thiophene (PEDOT), or a copper phthalocyanine (CuPc) may be used.

[0133] although BPPC, perylene, and DCM can use as a red luminous layer as a luminous layer, Eu complex (J. — Kido et.al, Appl.Phys., vol.35, and pp.L394- detailed to 396 and 1996.) shown especially by Eu (DBM)3 (Phen) has high monochromaticity with luminescence sharp in wavelength of 620nm.

[0134] Moreover, the ingredient which added several mol % of Quinacridone or, and a coumarin can be typically used for Alq3 (8-hydroxyquinoline alminium) as a green luminous layer. A chemical formula is as follows.

[0135]

[Formula 6]

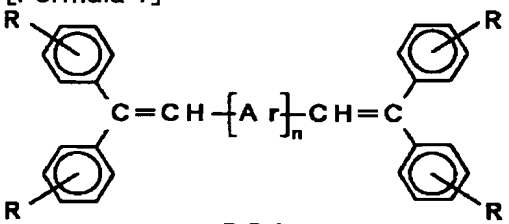


Alq3

[0136] Moreover, the JISUCHIRU arylene amine derivative which added the amino permutation DSA can be typically used for DSA (JISUCHIRU arylene derivative) as a blue luminous layer. It is desirable to use especially the JISUCHIRI ruby phenyl (DPVBi) which is an ingredient with the high engine performance. A chemical formula is as follows.

[0137]

[Formula 7]



DSA

[0138] Moreover, although it is possible for the protection electrode 352 to also protect the EL layer 350 from moisture or oxygen, it is good to form the 3rd passivation film 353 still more preferably. In this example, the silicon nitride film of 300nm thickness is prepared as the 3rd passivation film 353. You may form continuously without this 3rd passivation film's also carrying out atmospheric-air release after the protection electrode 352. Of course, as the 3rd passivation film 353, the same ingredient as the 3rd passivation film 50 of drawing 1 can be used.

[0139] Although 4 layer structures which become in a hole-injection layer, an electron hole transportation layer, a luminous layer, and an electron injection layer are used as EL layer in this example, various examples are already reported and combination may use which the configuration. Moreover, although a MgAg electrode is used as cathode of an EL element in this example, you may be other well-known ingredients.

[0140] Moreover, the protection electrode 352 has the typical metal membrane which is prepared in order to prevent degradation of the MgAg electrode 351, and uses aluminum as a principal component. Of course, other ingredients are sufficient. Moreover, since the EL layer 350 and the MgAg electrode 351 are very weak for moisture, it is desirable to form continuously without carrying out atmospheric-air release even of the protection electrode 352, and to protect EL layer from the open air.

[0141] In addition, what is necessary is just to set to 180-300nm (typically 200-250nm) thickness whose thickness of the EL layer 350 is 10-400nm (typically 60-160nm) and the MgAg electrode 351.

[0142] In this way, the active-matrix mold EL display of structure as shown in drawing 5 (C) is completed. By the way, by arranging TFT of the optimal structure not only for the pixel section but the drive circuit section, the active-matrix mold EL display of this example shows very high dependability, and its operating characteristic may also improve.

[0143] First, TFT which has the structure of reducing hot carrier impregnation so that a working speed may not be reduced as much as possible is used as an n channel mold TFT205 of the CMOS circuit which forms a drive circuit. In addition, as a drive circuit here, a shift register, a buffer, a level shifter, a sampling circuit (transfer gate), etc. are included. In performing a digital drive, signal transformation circuits, such as a D/A converter, are also included and it gets.

[0144] In the case of this example, as shown in drawing 5 (C), in the LDD field 357, the barrier layer of the n channel mold 205 has lapped with the gate electrode 313 on both sides of gate dielectric film 311 including the source field 355, the drain field 356, the LDD field 357, and the channel formation field 358.
[0145] The consideration for not reducing a working speed forms the LDD field only in a drain field side. Moreover, it is better for this n channel mold TFT205 to seldom have cared about the OFF state current value, and to attach greater importance than to it to a working speed. Therefore, as for the LDD field 357, it is desirable to keep in a gate electrode in piles completely, and to lessen a resistance component as much as possible. Namely, it is better to abolish the so-called offset.
[0146] Moreover, since degradation by hot carrier impregnation hardly worries the p channel mold TFT206 of a CMOS circuit, it is not necessary to prepare especially a LDD field. Of course, it is also possible to prepare a LDD field like the n channel mold TFT205, and to take the cure against a hot carrier.
[0147] In addition, also in a drive circuit, a sampling circuit is a particular for a while compared with other circuits, and a high current flows a channel formation field bidirectionally. That is, the role of a source field and a drain field interchanges. Furthermore, it is desirable to arrange TFT which needs to hold down an OFF state current value low as much as possible, and has the function of middle extent of TFT for switching and TFT for current control in such semantics.
[0148] Therefore, as for the n channel mold TFT which forms a sampling circuit, it is desirable to arrange TFT of structure as shown in drawing 9 . As shown in drawing 9 , a part of LDD fields 901a and 901b lap with the gate electrode 903 on both sides of gate dielectric film 902. This effectiveness is as explanation of TFT202 for current control having described, and, in the case of a sampling circuit, it differs in that the LDD fields 901a and 901b are formed in the form which faces across the channel formation field 904.
[0149] Moreover, the pixel of structure as shown in drawing 1 is formed, and the pixel section is formed. About the structure of TFT for switching formed in a pixel, and TFT for current control, since drawing 1 already explained, explanation here is omitted.
[0150] In addition, when completing to drawing 5 (C) in fact, it is desirable to carry out packaging (enclosure) by housing material, such as airtight high protection films (a laminate film, ultraviolet-rays hardening resin film, etc.) and a sealing can made from the ceramics, so that it may not be further put to the open air. In that case, the interior of housing material is made into an inert atmosphere, or the dependability (life) of EL layer improves by arranging a hygroscopic material (for example, barium oxide) inside.
[0151] Moreover, if processing of packaging etc. raises airtightness, the connector (flexible print circuit: FPC) for connecting the terminal and external signal terminal which were taken about from the component formed on the substrate or the circuit will be attached, and it will complete as a product. EL indicating equipment changed into such a condition that it can ship is called EL module in this specification.
[0152] The configuration of the active-matrix mold EL display of this example is explained here using the perspective view of drawing 6 . The active-matrix mold EL display of this example consists of the pixel section 602 formed on the glass substrate 601, a gate side drive circuit 603, and a source side drive circuit 604. TFT605 for switching of the pixel section is the n channel mold TFT, and is arranged at the intersection of the gate wiring 606 connected to the gate side drive circuit 603, and the source wiring 607 connected to the source side drive circuit 604. Moreover, the drain of TFT605 for switching is electrically connected to the gate of TFT608 for current control.
[0153] Furthermore, the source of TFT608 for current control is connected to the current supply source line 609, and EL element 610 is electrically connected to the drain of TFT608 for current control. At this time, if TFT608 for current control is the n channel mold TFT, it is desirable that the anode plate of EL element 610 is connected to that drain. Moreover, if TFT608 for current control is the p channel mold TFT, it is desirable that the cathode of EL element 610 is connected to the drain.

[0154] And the input wiring (connection wiring) 612 and 613 for transmitting a signal to a drive circuit and the input wiring 614 connected to the current supply source line 609 are formed in FPC611 used as an external input terminal.
[0155] Moreover, an example of the circuitry of EL display shown in drawing 6 is shown in drawing 7 . this example -- EL -- a display -- the source -- a side -- a drive -- a circuit -- 701 -- the gate -- a side -- a drive -- a circuit -- (-- A --) -- 707 -- the gate -- a side -- a drive -- a circuit -- (-- B --) -- 711 -- a pixel -- the section -- 706 -- having -- **** . In addition, it is the generic name with which the drive circuit included the source side drive circuit and the gate side drive circuit into this specification.
[0156] The source side drive circuit 701 is equipped with the shift register 702, the level shifter 703, the buffer 704, and the sampling circuit (sample and hold circuit) 705. Moreover, the gate side drive circuit (A) 707 is equipped with the shift register 708, the level shifter 709, and the buffer 710. The gate side drive circuit (B) 711 is also the same configuration.
[0157] As for shift registers 702 and 708, the structure by which, as for the n channel mold TFT used for the CMOS circuit which are 5-16V (typically 10 V), and forms a circuit, driver voltage is shown by 205 of drawing 5 (C) is suitable here.
[0158] Moreover, the CMOS circuit in which level shifters 703 and 709 and buffers 704 and 710 contain the n channel mold TFT205 of drawing 5 (C) like a shift register although driver voltage becomes high with 14-16V is suitable. In addition, it is effective to make gate wiring into multi-gate structures, such as double-gate structure and triple gate structure, when raising each circuit reliability.
[0159] Moreover, since a sampling circuit 705 needs to reduce an OFF state current value when a source field and a drain field are reversed although driver voltages are 14-16V, the CMOS circuit containing the n channel mold TFT208 of drawing 9 is suitable.
[0160] Moreover, driver voltages are 14-16V, and the pixel section 706 arranges the pixel of the structure shown in drawing 1 .
[0161] In addition, the above-mentioned configuration is easily realizable by producing TFT according to the production process shown in drawing 3 -5. Moreover, although this example shows only the configuration of the pixel section and a drive circuit, if the production process of this example is followed, I think that it is possible to form logical circuits other than drive circuits, such as a signal dividing network, a D/A converter circuit, an operational amplifier circuit, and a gamma correction circuit, on the same substrate, and the memory section, a microprocessor, etc. can be formed further.
[0162] Furthermore, EL module of this example also including housing material is explained using drawing 17 (A) and (B). In addition, the sign used by drawing 6 and drawing 7 if needed will be quoted.
[0163] On the substrate (the substrate film under TFT is included) 1700, the pixel section 1701, the source side drive circuit 1702, and the gate side drive circuit 1703 are formed. Various wiring from each drive circuit results in FPC611 through the input wiring 612-614, and is connected to an external instrument.
[0164] this time -- at least -- the pixel section -- as a drive circuit and the pixel section are surrounded preferably, the housing material 1704 is formed. In addition, outside an EL element, rather than **, inside dimension is the configuration or the sheet configuration of having a large crevice, and with adhesives 1705, as the housing material 1704 forms a closed space in collaboration with a substrate 1700, it fixes to a substrate 1700. At this time, an EL element will be in the condition of having been completely enclosed with said closed space, and will be completely intercepted from the open air. In addition, two or more housing material 1704 may be formed.
[0165] Moreover, insulating matter of the quality of the material of the housing material 1704, such as glass and a polymer, is desirable. For example, amorphous glass (******** glass, quartz, etc.), crystallization glass, ceramic glass, organic system resin (acrylic resin, styrene resin, polycarbonate system resin, epoxy system resin, etc.), and silicone system resin are mentioned. Moreover, the ceramics may be used. Moreover, if adhesives 1705 are insulating matter, it is also possible to use metallic materials, such as a stainless alloy.

[0166] Moreover, the quality of the material of adhesives 1705 can use adhesives, such as epoxy system resin and acrylate system resin. Furthermore, thermosetting resin and a photo-setting resin can also be used as adhesives. However, it is required to be the quality of the material which does not penetrate oxygen and moisture as much as possible.
[0167] Furthermore, as for the opening 1706 between housing material and a substrate 1700, it is desirable to be filled up with inert gas (an argon, helium, nitrogen, etc.). Moreover, it is possible not only gas but to use inactive liquids (representing [by the perfluoro alkane] liquefied fluorination carbon etc.). It is good with an ingredient which is used by JP,8-78159,A about the inactive liquid. Moreover, it may be filled up with resin.
[0168] Moreover, it is also effective to prepare a drying agent in an opening 1706. An ingredient which is indicated by JP,9-148066,A as a drying agent can be used. What is necessary is typically, just to use the barium oxide. Moreover, it is effective not only a drying agent but to form an antioxidant.
[0169] Moreover, as shown in drawing 17 (B), two or more pixels which have the EL element isolated separately are prepared in the pixel section, and they all have the protection electrode 1707 as a common electrode. Although [this example] it is desirable to carry out continuation formation without carrying out atmospheric-air release of EL layer, cathode (MgAg electrode), and the protection electrode, if EL layer and cathode are formed using the same mask material and only a protection electrode is formed by another mask material, the structure of drawing 17 (B) is realizable.
[0170] It is not necessary to prepare EL layer and cathode on a drive circuit that what is necessary is to prepare only the pixel section at this time. Of course, although it does not become a problem even if prepared on the drive circuit, it is more desirable not to prepare, if it takes into consideration that alkali metal is contained in EL layer.
[0171] In addition, the protection electrode 1707 is connected to the input wiring 1709 in the field shown by 1708. The input wiring 1709 is wiring for giving a predetermined electrical potential difference to the protection electrode 1707, and is connected to FPC611 through the conductive paste ingredient (typically different direction conductivity film) 1710.
[0172] Here explains the production process for realizing contact structure in a field 1708 using drawing 18 .
[0173] First, the condition of drawing 5 (A) is acquired according to the process of this example. At this time, in a substrate edge (field shown by 1708 in drawing 17 (B)), the 1st interlayer insulation film 336 and gate dielectric film 311 are removed, and the input wiring 1709 is formed on it. Of course, it is formed in the source wiring of drawing 5 (A) and drain wiring, and coincidence. (Drawing 18 (A))
[0174] Next, in case the 2nd passivation film 348, the 2nd interlayer insulation film 347, and the 1st passivation film 344 are etched in drawing 5 (B), the field shown by 1801 is removed and an aperture 1802 is formed. (Drawing 18 (B))
[0175] In the pixel section, the formation process (a pixel electrode, EL layer, and formation process of cathode) of an EL element is performed in this condition. Under the present circumstances, in the field shown in drawing 18 , an EL element is made not to be formed using mask material. And after forming cathode 351, the protection electrode 352 is formed using another mask material. Thereby, the protection electrode 352 and the input wiring 1709 are connected electrically. Furthermore, the 3rd passivation film 353 is formed and the condition of drawing 18 (C) is acquired.
[0176] Contact structure of the field shown by 1708 of drawing 17 (B) according to the above process is realized. And the input wiring 1709 is a clearance between the housing material 1704 and a substrate 1700 (however, it fills up with adhesives 1705.). That is, the thickness which can fully carry out flattening of the level difference of input wiring is required for adhesives 1705. It passes and connects with FPC611. In addition, although the input wiring 1709 was explained here, other input wiring 612-614 is similarly connected to FPC611 through the bottom of the housing material 1704.
[0177] [Example 2] This example shows a different example from the configuration which showed the configuration of a pixel to drawing 2 (B) to drawing 10 .

[0178] In this example, two pixels shown in drawing 2 (B) are arranged so that it may become symmetrical about a current supply source line. That is, as shown in drawing 10 , the number of wiring to need can be reduced by communalizing the current supply source line 213 between two adjoining pixels. In addition, the TFT structure arranged in a pixel remains as it is, and is good.
[0179] It becomes possible to produce such a configuration, then the higher definition pixel section, and the quality of an image improves.
[0180] In addition, according to the production process of an example 1, it can realize easily, and just refer to the explanation of an example 1 or drawing 1 for the configuration of this example about TFT structure etc.
[0181] [Example 3] This example explains the case where the pixel section of different structure from drawing 1 is formed, using drawing 11 . In addition, the process which forms the 2nd interlayer insulation film 44 should just follow an example 1. Moreover, since TFT201 for switching and TFT202 for current control which were covered with the 2nd interlayer insulation film 44 are the same structure as drawing 1 , explanation here is omitted.
[0182] If a contact hole is formed to the 2nd passivation film 45, the 2nd interlayer insulation film 44, and the 1st passivation film 41 in the case of this example, the pixel electrode 51, cathode 52, and the EL layer 53 will be formed. Although continuously formed in this example with the vacuum deposition method which does not carry out atmospheric-air release of cathode 52 and the EL layer 53, mask material is used in that case and EL layer of red luminescence, EL layer of green luminescence, and EL layer of blue luminescence are alternatively formed in a separate pixel at it. In addition, although only one pixel is illustrated to drawing 11 , the pixel of the same structure is formed corresponding to each color of red, green, or blue, and, thereby, color display can be performed. EL layer of each [these] color should just adopt a well-known ingredient.
[0183] In this example, the aluminium alloy film (aluminum film containing 1wt% titanium) of 150nm thickness is prepared as a pixel electrode 51. In addition, although what kind of ingredient is sufficient as long as it is a metallic material as an ingredient of a pixel electrode, it is desirable that it is an ingredient with a high reflection factor. Moreover, the thickness of the EL layer 53 may be 120nm, using the MgAg electrode of 230nm thickness as cathode 52.
[0184] Next, the anode plate 54 which consists of transparence electric conduction film (this example ITO film) is formed in the thickness of 110nm. In this way, if EL element 209 is formed and the 3rd passivation film 55 is formed as the ingredient shown in the example 1 is also, the pixel of structure as shown in drawing 11 will be completed.
[0185] When it considers as the structure of this example, the red generated by each pixel and a green or blue light are emitted to the opposite side with the substrate in which TFT was formed. Therefore, it can use as an effective luminescence field mostly, the whole region, i.e., the field in which TFT was formed, in a pixel. Consequently, the effective luminescence area of a pixel improves sharply and the brightness and the contrast ratio (ratio of light and darkness) of an image improve.
[0186] In addition, the configuration of this example can be freely combined with any configuration of examples 1 and 2.
[0187] [Example 4] This example explains the case where the pixel of different structure from drawing 2 of an example 1 is formed, using drawing 12 (A) and (B).
[0188] In drawing 12 (A), 1201 is TFT for switching and includes a barrier layer 56, gate electrode 57a, gate wiring 57b, source wiring 58, and the drain wiring 59 as a configuration. Moreover, 1202 is TFT for current control and includes a barrier layer 60, the gate electrode 61, source wiring (current supply source line) 62, and the drain wiring 63 as a configuration. Moreover, the source wiring 62 of TFT1202 for current control is connected to the current supply source line 64, and the drain wiring 63 is connected to EL element 65. Drawing 12 (B) expressed the circuitry of this pixel.
[0189] The difference between drawing 12 (A) and drawing 2 (A) is the structure of TFT for switching. In this example, 0.1-5 micrometers and thin gate electrode 57a are formed, and as line breadth crosses the part, it forms a barrier layer 56. And gate wiring 57b is formed so that

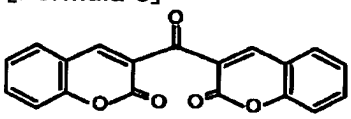
gate electrode 57a of each pixel may be connected electrically. Triple gate structure is realized without this having area so chiefly.
[0190] Although other parts are the same as that of drawing 2 (A), since the area which TFT for switching has chiefly will become small if it is structure like this example, effective luminescence area becomes large, namely, the brightness of an image improves. Moreover, since gate structure which raised the redundancy for reducing an OFF state current value can be realized, improvement in the further image quality can be aimed at.
[0191] In addition, the configuration of this example may communalize the current supply source line 64 like an example 2 between the adjoining pixels, and is good also as structure like an example 3. Moreover, what is necessary is just to follow an example 1 about a production process.
[0192] [Example 5] Although examples 1-4 explained the case of the top gate mold TFT, this invention may be carried out using the bottom gate mold TFT. This example shows the case where this invention is carried out with the reverse stagger mold TFT to drawing 13 . In addition, except TFT structure, since it is the same as that of the structure of drawing 1 , the same sign as drawing 1 is used if needed.
[0193] In drawing 13 , the same ingredient as an example 1 can be used for a substrate 11 and the substrate film 12. And on the substrate film 12, TFT1301 for switching and TFT1302 for current control are formed.
[0194] The configuration of TFT1301 for switching includes the gate electrodes 70a and 70b, the gate wiring 71, gate dielectric film 72, the source field 73, the drain field 74, the LDD fields 75a-75d, the high concentration impurity range 76, the channel formation fields 77a and 77b, the channel protective coats 78a and 78b, the 1st interlayer insulation film 79, source wiring 80, and the drain wiring 81.
[0195] Moreover, the configuration of TFT1302 for current control includes the gate electrode 82, gate dielectric film 72, the source field 83, the drain field 84, the LDD field 85, the channel formation field 86, the channel protective coat 87, the 1st interlayer insulation film 79, source wiring 88, and the drain wiring 89. At this time, the gate electrode 82 is electrically connected with the drain wiring 84 of TFT1301 for switching.
[0196] In addition, what is necessary is just to form above-mentioned TFT1301 for switching, and TFT1302 for current control by the production approach of the well-known reverse stagger mold TFT. Moreover, as for (ingredients, such as wiring, an insulator layer, and a barrier layer), at least each part which forms Above TFT can use the same ingredient as each part which corresponds in the top gate mold TFT of an example 1. However, what is necessary is just to form by the insulator layer containing silicon about the channel protective coats 78a, 78b, and 87 which are not in the configuration of the top gate mold TFT. Moreover, what is necessary is to change high impurity concentration and just to form according to an individual using a photolithography technique, about formation of impurity ranges, such as a source field, a drain field, or a LDD field.
[0197] If TFT is completed, the pixel which carries out sequential formation of the 1st passivation film 41, a color filter 42, a fluorescent substance 43, the 2nd interlayer insulation film (flattening film) 44, the 2nd passivation film 45, the pixel electrode (anode plate) 46, the EL layer 47, the MgAg electrode (cathode) 48, the aluminum electrode (protection electrode) 49, and the 3rd passivation film 50, and has EL element 1303 will be completed. What is necessary is just to refer to an example 1 about these production processes and ingredients.
[0198] In addition, the configuration of this example can be freely combined with any configuration of examples 2-4.
[0199] [Example 6] In drawing 5 (C) of an example 1, or the structure of drawing 1 , it is effective to use the high ingredient of the heat dissipation effectiveness like the 2nd passivation film 45 as substrate film prepared between a barrier layer and a substrate. In order that especially TFT for current control may pass many currents, it is easy to generate heat, and degradation by self-generation of heat can pose a problem. In such a case, the substrate film can prevent the heat deterioration of TFT by having the heat dissipation effectiveness like this example.

[0200] Of course, it is also desirable the effectiveness protected from the movable ion diffused from a substrate and to use the laminated structure of the 1st passivation film 41, the compound which contains Si, aluminum, N, O, and M similarly, and the insulator layer containing silicon, since it is important.
[0201] In addition, the configuration of this example can be freely combined with any configuration of examples 1-5.
[0202] [Example 7] When it considers as the pixel structure shown in the example 3, since the light emitted from EL layer is emitted to the opposite side, it does not need to care about permeability, such as an insulator layer which exists between a substrate and a pixel electrode, with a substrate. That is, even if it is an ingredient with low permeability somewhat, it can use.
[0203] Therefore, it is advantageous when using the carbon film called a diamond thin film, the diamond-like carbon film, or the amorphous carbon film as the substrate film 12, the 1st passivation film 41, or the 2nd passivation film 45. That is, since it is not necessary to care about decline in permeability, thickness can be thickly set up like 100-500nm, and it is possible to heighten the heat dissipation effectiveness more.
[0204] In addition, since the decline in permeability should be too avoided about the case where the above-mentioned carbon film is used for the 3rd passivation film 50, as for thickness, it is desirable to make it about 5-100nm.
[0205] In addition, when using a carbon film for any of the substrate film 12, the 1st passivation film 41, the 2nd passivation film 45, or the 3rd passivation film 50 also in this example, it is effective to carry out a laminating to other insulator layers, and to use.
[0206] In addition, this example is effective when considering as the pixel structure shown in the example 3, and it is possible to combine with any configuration of examples 1-6 freely about other configurations.
[0207] [Example 8] In this invention, by making TFT for switching into multi-gate structure in the pixel of EL indicating equipment, the OFF state current value of TFT for switching was reduced, and the need for retention volume is eliminated. This is a device for utilizing the area of retention volume which it has chiefly effectively as a luminescence field.
[0208] however, lose retention volume completely -- the effectiveness of extending effective luminescence area only by making monopoly area small is acquired also until there is nothing. That is, it is enough by making TFT for switching into multi-gate structure to reduce an OFF state current value and just to contraction-ize monopoly area of retention volume.
[0209] Therefore, it is also possible to consider as pixel structure as shown in drawing 14 . In addition, in drawing 14 , the same sign as drawing 1 is quoted if needed.
[0210] The difference between drawing 14 and drawing 1 is a point that the retention volume 1401 connected to TFT for switching exists. Retention volume 1401 is formed with the semiconductor region (lower electrode) 1402, the gate dielectric film 18, and the capacity electrode (up electrode) 1403 which were extended from the drain field 14 of TFT201 for switching. This capacity electrode 1403 is formed in the gate electrodes 19a, 19b, and 35 and coincidence of TFT.
[0211] Besides, a field Fig. is shown in drawing 15 (A). The sectional view which cut the plan of drawing 15 (A) with A-A' is equivalent to drawing 14 . Drawing 15 (A) The capacity electrode 1403 is electrically connected with the source field 31 of TFT for current control through the connection wiring 1404 connected electrically so that it may be shown. In addition, the connection wiring 1404 is formed in source wiring 21 and 36 and the drain wiring 22 and 37, and coincidence. Moreover, drawing 15 (B) expresses the circuitry of a plan shown in drawing 15 (A).
[0212] In addition, the configuration of this example is freely combinable with any configuration of examples 1-7. That is, retention volume is only prepared in a pixel and limitation is added to neither TFT structure nor the ingredient of EL layer.
[0213] [Example 9] In the example 1, although laser crystallization is used as means forming of the crystalline substance silicon film 302, the case where a different crystallization means is used is explained in this example.

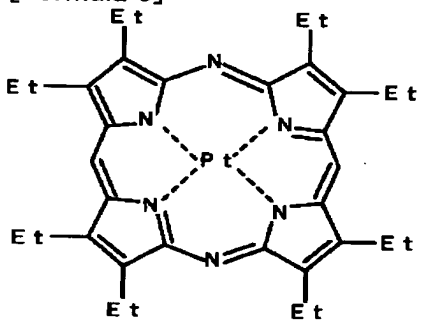
[0214] In this example, after forming the amorphous silicon film, it crystallizes using the technique indicated by JP,7-130652,A. The technique indicated by this official report is a technique of considering as the catalyst which promotes crystallization (promotion) and obtaining the crystalline high crystalline substance silicon film using elements, such as nickel.
[0215] Moreover, after a crystallization process is completed, the process which removes the catalyst used for crystallization may be performed. In that case, what is necessary is just to carry out gettering of the catalyst with the technique indicated by JP,10-270363,A or JP,8-330602,A.
[0216] Moreover, TFT may be formed using the technique indicated by the application specification of Japanese Patent Application No. 11-076967 by these people.
[0217] As mentioned above, the production process shown in the example 1 is one example, and if the structure of drawing 5 (C) of drawing 1 or an example 1 is realizable, it will be satisfactory even if it uses other production processes.
[0218] In addition, the configuration of this example can be freely combined with any configuration of examples 1-8.
[0219] [Example 10] In driving EL display of this invention, the analog drive using the analog signal as a picture signal can also be performed, and the digital drive using a digital signal can also be performed.
[0220] When performing an analog drive, an analog signal is sent to the source wiring of TFT for switching, and an analog signal including the gradation information serves as gate voltage of TFT for current control. And the current which flows to an EL element is controlled by TFT for current control, the luminescence reinforcement of an EL element is controlled, and a gradation display is performed. In this case, as for TFT for current control, it is desirable to make it operate in a saturation region. That is, it is desirable to make it operate within the condition of $|Vds|>|Vgs-Vth|$. In addition, Vds is [the electrical potential difference between a source field and a gate electrode and Vth of the electrical potential difference between a source field and a drain field and Vgs] the threshold electrical potential differences of TFT here.
[0221] On the other hand, when performing a digital drive, unlike an analog gradation display, the gradation display called a time-sharing drive (time amount gradation drive) or an area gradation drive is performed. That is, by adjusting the die length and the rate of luminescence surface ratio of luminescence time amount, it shows as color gradation is changing visually. In this case, as for TFT for current control, it is desirable to make it operate in a linearity field. That is, it is desirable to make it operate within the condition of $|Vds|<|Vgs-Vth|$.
[0222] Since the speed of response is very quick compared with a liquid crystal device, an EL element can be driven at high speed. Therefore, it can be said that it is a component suitable for the time-sharing drive which divides one frame into two or more subframes, and performs a gradation display. Moreover, it can be said that it is advantageous when the time amount holding the gate voltage of TFT for current control is also short, it ends, and retention volume is made small or it omits, since the one-frame period is short.
[0223] Thus, since this invention is a technique about component structure, the drive approach may be what kind of thing.
[0224] [Example 11] This example shows the example of the pixel structure of EL display of this invention to drawing 21 (A) and (B). in addition, this example — setting — 4701 — the source wiring of TFT4702 for switching, and 4703 — in TFT for current control, and 4705, TFT for power control and 4707 make it as gate wiring for power control, and 4708 makes a current supply source line and 4706 an EL element for gate wiring of TFT4702 for switching, and 4704. About actuation of TFT4706 for power control, it is good to refer to Japanese Patent Application No. No. 341272 [11 to].
[0225] Moreover, although TFT4706 for power control is formed between TFT4704 for current control, and EL element 4708 in this example, it is good also as structure where TFT4704 for current control was formed between TFT4706 for power control, and EL element 4708. Moreover, as for TFT4706 for power control, it is desirable to consider as the same structure as TFT4704 for current control, or to carry out a serial by the same barrier layer, and to form.

[0226] Moreover, drawing 21 (A) is an example at the time of making the current supply source line 4705 common between two pixels. That is, the description is formed so that two pixels may serve as axial symmetry focusing on the current supply source line 4705. In this case, since the number of a current supply source line can be reduced, the pixel section can be further made highly minute.
[0227] Moreover, drawing 21 (B) is an example at the time of forming the current supply source line 4710 in parallel with the gate wiring 4703, and forming the gate wiring 4711 for power control in parallel with source wiring 4701. In addition, although it has structure established so that the current supply source line 4710 and the gate wiring 4703 might not lap in drawing 21 (B), if it is wiring formed in the layer from which both differ, it can also prepare so that it may lap on both sides of an insulator layer. In this case, since the current supply source line 4710 and the gate wiring 4703 can be made to share monopoly area, the pixel section can be further made highly minute.
[0228] [Example 12] This example shows the example of the pixel structure of EL display of this invention to drawing 22 (A) and (B). in addition, this example -- setting -- 4801 -- the source wiring of TFT4802 for switching, and 4803 -- in TFT for current control, and 4805, TFT for elimination and 4807 make it as gate wiring for elimination, and 4808 makes a current supply source line and 4806 an EL element for gate wiring of TFT4802 for switching, and 4804. About actuation of TFT4806 for elimination, it is good to refer to Japanese Patent Application No. No. 338786 [11 to].
[0229] It can connect with the gate of TFT4804 for current control, and the drain of TFT4806 for elimination can change now compulsorily the gate voltage of TFT4804 for current control. In addition, although TFT4806 for elimination is good also as a p channel mold TFT also as an n channel mold TFT, it is desirable to consider as the same structure as TFT4802 for switching so that the OFF state current can be made small.
[0230] Moreover, drawing 22 (A) is an example at the time of making the current supply source line 4805 common between two pixels. That is, the description is formed so that two pixels may serve as axial symmetry focusing on the current supply source line 4805. In this case, since the number of a current supply source line can be reduced, the pixel section can be further made highly minute.
[0231] Moreover, drawing 22 (B) is an example at the time of forming the current supply source line 4810 in parallel with the gate wiring 4803, and forming the gate wiring 4811 for elimination in parallel with source wiring 4801. In addition, although it has structure established so that the current supply source line 4810 and the gate wiring 4803 might not lap in drawing 22 (B), if it is wiring formed in the layer from which both differ, it can also prepare so that it may lap on both sides of an insulator layer. In this case, since the current supply source line 4810 and the gate wiring 4803 can be made to share monopoly area, the pixel section can be further made highly minute.
[0232] [Example 13] EL display of this invention is good also as structure which prepared how many TFT(s) in the pixel. Although examples 11 and 12 show the example which prepared three TFT(s), four thru/or six TFT(s) may be prepared. This invention can be carried out without being limited to the pixel structure of EL display.
[0233] [Example 14] This example explains the example at the time of using the p channel mold TFT as TFT202 for current control of drawing 1 . In addition, since other parts are the same as that of drawing 1 , detailed explanation is omitted.
[0234] The cross-section structure of the pixel of this example is shown in drawing 23 . The production approach of the p channel mold TFT used by this example should just refer to an example 1. Including the source field 91, the drain field 92, and the channel formation field 93, the source field 91 is connected to source wiring 36, and the drain field 92 is connected to the drain wiring 37 for the barrier layer of the p channel mold TFT.
[0235] Thus, when the anode plate of an EL element is connected to TFT for current control, it is desirable to use the p channel mold TFT as TFT for current control.
[0236] In addition, it combines with any configuration of examples 1-13 freely, and the

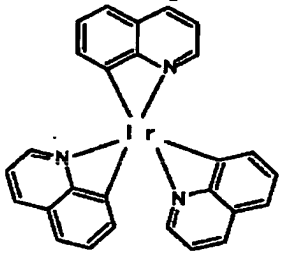
configuration of this example can be carried out.
[0237] [Example 15] In this invention, external luminescence quantum efficiency can be raised by leaps and bounds by using EL ingredient which can use the phosphorescence from a triplet exciton for luminescence. Thereby, low-power-izing of an EL element, reinforcement, and lightweight-ization are attained. Here, a triplet exciton is used and the report which raised external luminescence quantum efficiency is shown.
(T. Tsutsui, C.Adachi, S.Saito, Photochemical Processes in Organized Molecular Systems, ed.KHonda (Elsevier Sci.Pub., Tokyo, 1991), p.437.) The molecular formula of EL ingredient (coumarin coloring matter) reported to the above-mentioned paper is shown below.
[0238]
[Formula 8]



[0239] (M. A.Baldo, D.F.O'Brien, Y.You, A.Shoustikov, S.Sibley, M.E.Thompson, S.R.Forrest, Nature 395 (1998) p.151.) The molecular formula of EL ingredient (Pt complex) reported to the above-mentioned paper is shown below.
[0240]
[Formula 9]



[0241] It Lamansk(ies). M. — A.Baldo and S. — P. E.Burrrows and M.E.Thompson, S. — R.Forrest, Appl.Phys.Lett., and 75 (1999) p.4. (it Watanabe(s) T. — Tsutsui, M.-J.Yang, M.Yahiro, KNakamura, and T. —) T. (1999) The molecular formula of EL ingredient (Ir complex) reported to tsuji, Y.Fukuda, T.Wakimoto, S.Mayaguchi, Jpn.Appl.Phys., and the 38 (12B) L1502. above-mentioned paper is shown below.
[0242]
[Formula 10]



[0243] If phosphorescence luminescence from a triplet exciton can be used as mentioned above, implementation of one 3 to 4 times the high external luminescence quantum efficiency of this will be attained from the case where the firefly luminescence from a singlet exciton is used theoretically. In addition, it combines with any configuration of an example 1 - an example 14 freely, and the configuration of this example can be carried out.
[0244] [Example 16] Although [an example 1] it is desirable to use an organic electroluminescence ingredient as an EL layer, even if this invention uses inorganic EL ingredient, it can be carried out. However, since driver voltage is very high, the present

inorganic EL ingredient must use TFT which has the proof-pressure property that such driver voltage can be borne, when performing an analog drive.
[0245] Or if inorganic EL ingredient with prospective still lower driver voltage is developed, applying to this invention is possible.
[0246] Moreover, the configuration of this example can be freely combined with any configuration of examples 1-14.
[0247] [Example 17] Since the active-matrix mold EL indicating equipment (EL module) formed by carrying out this invention is a spontaneous light type, it is excellent in the visibility in a bright location compared with the liquid crystal display. Therefore, an application is large as an EL display (the display display incorporating EL module is pointed out) of a direct viewing type.
[0248] In addition, the size of an angle of visibility is mentioned as one of the points with a more advantageous EL display than a liquid crystal display. Therefore, it is good to use the EL display of this invention for appreciating TV broadcast etc. by the big screen as a display display (display monitor) of 30 inches or more (typically 40 inches or more) of vertical angles.
[0249] Moreover, it not only uses as EL displays (a personal computer monitor, the monitor for TV broadcast reception, advertising display monitor, etc.), but it can use as a display display of various electronic instruments.
[0250] As such an electronic instrument, the picture reproducer (equipment equipped with the display which specifically reproduces record media, such as a compact disk (CD), a laser disc (trademark) (LD), or a digital videodisc (DVD), and can display the image) equipped with a video camera, a digital camera, a goggles mold display (head mount display), car navigation, a personal computer, Personal Digital Assistants (a mobile computer, a cellular phone, or digital book), and a record medium etc. is mentioned. The example of these electronic instruments is shown in drawing 16 .
[0251] Drawing 16 (A) is a personal computer and contains a body 2001, a case 2002, a display 2003, and a keyboard 2004. This invention can be used for a display 2003.
[0252] Drawing 16 (B) is a video camera and contains a body 2101, a display 2102, the voice input section 2103, the actuation switch 2104, a dc-battery 2105, and the television section 2106. This invention can be used for a display 2102.
[0253] Drawing 16 (C) is a goggles mold display, and contains a body 2201, a display 2202, and the arm section 2203. This invention can be used for a display 2202.
[0254] Drawing 16 (D) is a pocket mold (mobile) computer, and contains a body 2301, the camera section 2302, the television section 2303, the actuation switch 2304, and a display 2305. This invention can be used for a display 2405.
[0255] drawing 16 -- (-- E --) -- a record medium -- having had -- picture reproducer (specifically DVD regenerative apparatus) -- it is -- a body -- 2401 -- record media (CD, LD, or DVD) -- 2402 -- actuation -- a switch -- 2403 -- a display -- (-- a --) -- 2404 -- a display -- (-- b --) -- 2405 -- containing . This invention can be used for these displays (a) and (b), although a display (a) mainly displays image information and a display (b) mainly displays text. In addition, this invention can be used for CD regenerative apparatus, a game device, etc. as picture reproducer equipped with the record medium.
[0256] Drawing 16 (F) is an EL display and contains a case 2501, susceptor 2502, and a display 2503. This invention can be used for a display 2503. Especially the EL display of this invention is advantageous when it big-screen-izes, and it is advantageous to the display of 10 inches or more (30 inches or more of vertical angles [Especially]) of vertical angles.
[0257] Moreover, if the luminescence brightness of EL ingredient will become high in the future, it will also become possible to use for the projector of a front mold or a rear mold.
[0258] Moreover, the above-mentioned electronic instrument displays more often the information distributed through electronic communication lines, such as the Internet and CATV (cable television), and its opportunity to display especially animation information has been increasing. Since the speed of response of EL ingredient is very high, it is suitable for performing such a movie display.
[0259] Moreover, in order that the part which is emitting light may consume power, as for EL

display, it is desirable to display information that the amount of light-emitting part decreases as much as possible. Therefore, when using EL display for the display which is mainly concerned with text like a Personal Digital Assistant especially a cellular phone, or a car audio, it is desirable to drive so that text may be formed by part for a light-emitting part by making a part for a non-light-emitting part into a background.

[0260] Drawing 20 (A) is a cellular phone and contains a body 2601, the voice output section 2602, the voice input section 2603, a display 2604, the actuation switch 2605, and an antenna 2606 here. EL display of this invention can be used for a display 2604. In addition, a display 2604 can stop the power consumption of a cellular phone by displaying a white alphabetic character on a black background.

[0261] Moreover, drawing 20 (B) is an audio for mount (car audio), and includes a body 2701, a display 2702, and the actuation switches 2703 and 2704. EL display of this invention can be used for a display 2702. Moreover, although this example shows the audio for mount, you may use for a non-portable audio. In addition, a display 2704 can stop power consumption by displaying a white alphabetic character on a black background.

[0262] As mentioned above, the applicability of this invention is very wide, and applying to the electronic instrument of all fields is possible. Moreover, even if the electronic instrument of this example uses the configuration which consists of combination like an example 1 - 16 throats, it is realizable.

[0263]

[Effect of the Invention] By using this invention, it can control that an EL element deteriorates with moisture or heat. Moreover, it can prevent spreading alkali metal from EL layer and having a bad influence on a TFT property. Consequently, the engine performance of operation and dependability of EL display can be raised sharply.

[0264] Moreover, by having such an EL indicating equipment as a display display, image quality is good and it becomes possible to produce a durable (for it to be reliable) application product (electronic instrument).

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the electronic instrument (electron device) which has the electro-optic device represented by EL (electroluminescence) indicating equipment which made the semiconductor device (component using a semi-conductor thin film) on the substrate, and was formed, and its electro-optic device as a display display (it is also called a display).

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PRIOR ART

[Description of the Prior Art] In recent years, on the substrate, the technique which forms TFT progresses sharply and application development to a active-matrix mold display is furthered. Since electric field effect mobility (it is also called mobility) is higher than TFT which used the conventional amorphous silicon film, high-speed operation is possible for especially TFT using the polish recon film. Therefore, it is possible to perform control of a pixel in the drive circuit besides a substrate conventionally in the drive circuit formed on the same substrate as a pixel.

[0003] Such a active-matrix mold display attracts attention noting that various advantages, such as reduction of a manufacturing cost, a miniaturization of a display, a rise of the yield, and reduction of a throughput, are acquired by making various circuits and components on the same substrate.

[0004] A active-matrix mold EL indicating equipment prepares the switching element which becomes each of each pixel by TFT, operates the driver element which performs current control by the switching element, and makes EL layer (luminous layer) emit light. For example, the United-States-patent number No. (Japan public-presentation official report: refer to JP,8-234683,A) 5,684,365, the Japan public-presentation official report: There is an EL display indicated by JP,10-189252,A.

[0005] In these EL display, degradation of EL ingredient by moisture poses a problem. Especially an organic system EL ingredient deteriorates not only by moisture but by oxygen. Therefore, it was common to have changed an EL element into a sealing condition and to have intercepted from moisture etc. as indicated by JP,8-78159,A.

[0006] However, the problem which EL layer has is not only moisture. EL layer contains alkali metal, such as sodium (Na), in itself, and if the alkali metal is spread to TFT, it can cause the serious failure for actuation of TFT. Moreover, since EL layer is weak with heat, degradation by accumulation also poses a problem. In addition, in this specification, it is called "alkali metal" including alkali metal and alkaline earth metal.

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EFFECT OF THE INVENTION

[Effect of the Invention] By using this invention, it can control that an EL element deteriorates with moisture or heat. Moreover, it can prevent spreading alkali metal from EL layer and having a bad influence on a TFT property. Consequently, the engine performance of operation and dependability of EL display can be raised sharply.
[0264] Moreover, by having such an EL indicating equipment as a display display, image quality is good and it becomes possible to produce a durable (for it to be reliable) application product (electronic instrument).

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is made in view of the above-mentioned conventional technique, and let it be a technical problem to offer the engine performance of operation and a reliable electro-optic device, especially EL display. And let it be a technical problem to raise the quality of the electronic instrument (electron device) which has it as a display for a display by raising the image quality of an electro-optic device.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned technical problem, in this invention, degradation by the water of an EL element, degradation by heat, and emission of alkali metal are prevented. It considers as the condition of having specifically prepared the insulator layer which may fill these to coincidence in contact with the EL element, or having surrounded the EL element still more preferably as such an insulator layer is also.
[0009] That is, the insulator layer which there is the blocking effectiveness over moisture and alkali metal, and also has the heat dissipation effectiveness is prepared in the location near [as possible] an EL element, and degradation of an EL element is controlled by this insulator layer.
[0010] Moreover, when such an insulator layer cannot be used by the monolayer, the laminating of the insulator layer which has the blocking effectiveness over moisture and alkali metal, and the insulator layer which has the heat dissipation effectiveness can be carried out, and it can also be used. Furthermore, the laminating of the insulator layer which has the blocking effectiveness over moisture, the insulator layer which has the blocking effectiveness over alkali metal, and the insulator layer which has the heat dissipation effectiveness can be carried out, and it can also be used.
[0011] Anyway, in order to control degradation (you may call it degradation of an EL element) of EL layer, it is necessary to take the cure to heat, moisture, and alkali metal against the TFT itself which must take a cure with both moisture and heat against coincidence, and drives an EL element.
[0012]
[Embodiment of the Invention] The gestalt of operation of this invention is explained using drawing 1 and drawing 2 . It is the sectional view of the pixel of EL display which is this invention which was shown in drawing 1 , and drawing 2 (A) is the plan and drawing 2 (B) is the circuitry. Two or more arrays of such a pixel are carried out in fact at the shape of a matrix, and the pixel section (image display section) is formed.
[0013] In addition, the sectional view of drawing 1 shows the cutting plane cut by A-A' in the plan shown in drawing 2 (A). Since the common sign is used by drawing 1 and drawing 2 here, it is good to refer to both drawings suitably. Moreover, both are the same structures although two pixels are illustrated in the plan of drawing 2 .
[0014] In drawing 1 , it is the insulator layer (henceforth the substrate film) from which 11 becomes a substrate and 12 becomes a substrate. As a substrate 11, a glass substrate, a crystallized glass substrate, a quartz substrate, a silicon substrate, a ceramic substrate, a metal substrate, or a plastic plate (plastic film is also included) can be used.
[0015] Moreover, although especially the substrate film 12 is effective when using the substrate containing movable ion, and the substrate which has conductivity, you may not prepare in a quartz substrate. What is necessary is just to use the insulator layer containing silicon (silicon) as substrate film 12. In addition, in this specification, "the insulator layer containing silicon" points out the insulator layer which specifically contains silicon, such as oxidation silicon film, a silicon nitride film, or nitriding oxidation silicon film (shown by SiOxNy), oxygen, or nitrogen at a predetermined rate.
[0016] Moreover, it is effective to make generation of heat of TFT emit by giving the heat dissipation effectiveness to the substrate film 12, also in order to prevent degradation of TFT,

or degradation of an EL element. All well-known ingredients can be used for giving the heat dissipation effectiveness.
[0017] Here, two TFT(s) are formed in a pixel. TFT (henceforth TFT for switching) on which 201 functions as a component for switching, and 202 are TFT(s) (henceforth TFT for current control) which function as a component for current control which controls the amount of currents passed to an EL element, and are formed by both with the n channel mold TFT.
[0018] For the electric field effect mobility of the n channel mold TFT, since it is larger than the electric field effect mobility of the p channel mold TFT, a working speed is a sink and a cone about a high current early. Moreover, TFT size can do the direction of the n channel mold TFT small also passing the same amount of currents. Therefore, since the direction which used the n channel mold TFT as TFT for current control becomes large, its effective area of a display is desirable.
[0019] Hot carrier impregnation hardly becomes a problem, but the p channel mold TFT has the advantage that an OFF state current value is low, and the example used as TFT for switching and the example used as TFT for current control are already reported. However, in this invention, also in the n channel mold TFT, the problem of hot carrier impregnation and the problem of an OFF state current value are solved by considering as the structure where the location of a LDD field was changed, and the description is that it is using all TFT(s) in all pixels as the n channel mold TFT.
[0020] However, in this invention, it is also possible for it not to be necessary to limit TFT for switching and TFT for current control to the n channel mold TFT, and to use the p channel mold TFT for both or either one of the two.
[0021] TFT201 for switching has the drain wiring 22 in a barrier layer including the source field 13, the drain field 14, the LDD fields 15a-15d, the high concentration impurity range 16, and the channel formation fields 17a and 17b, gate dielectric film 18, the gate electrodes 19a and 19b, the 1st interlayer insulation film 20, and source wiring 21 list, and is formed in them.
[0022] Moreover, as shown in drawing 2 , the gate electrodes 19a and 19b have double-gate structure electrically connected by the gate wiring 211 formed with another ingredient (gate electrodes 19a and 19b low ingredient [****]). Of course, you may be the so-called multi-gate structures (structure containing the barrier layer which has two or more channel formation fields connected to the serial), such as not only double-gate structure but triple gate structure. Multi-gate structure is very effective when reducing an OFF state current value, and in this invention, low TFT for switching of an OFF state current value is realized by making TFT201 for switching of a pixel into multi-gate structure.
[0023] Moreover, a barrier layer is formed by the semi-conductor film including the crystal structure. That is, the single crystal semiconductor film is sufficient and the polycrystal semi-conductor film and the microcrystal semi-conductor film are sufficient. Moreover, what is necessary is just to form gate dielectric film 18 by the insulator layer containing silicon. Moreover, all electric conduction film can be used as a gate electrode, source wiring, or drain wiring.
[0024] Furthermore, in TFT201 for switching, the LDD fields 15a-15d are formed so that it may not lap with the gate electrodes 17a and 17b on both sides of gate dielectric film 18. Such structure is very effective when reducing an OFF state current value.
[0025] In addition, it is still more desirable to prepare an offset field (field where it becomes in the semi-conductor layer of the same presentation as a channel formation field, and gate voltage is not impressed) between a channel formation field and a LDD field, when lowering an OFF state current value. Moreover, in the case of the multi-gate structure of having two or more gate electrodes, the high concentration impurity range prepared between channel formation fields is effective for reduction of an OFF state current value.
[0026] As mentioned above, a switching element with a fully low OFF state current value is realizable by using TFT of multi-gate structure as TFT201 for switching of a pixel. Therefore, even if it does not form a capacitor like drawing 2 of JP,10-189252,A, the gate voltage of TFT for [sufficient] time amount (after being chosen until it is chosen as degree) current control can be maintained.

[0027] That is, it becomes possible to eliminate conventionally the capacitor used as the factor which narrows effective luminescence area, and it becomes possible to make effective luminescence area large. This means that image quality of EL display can be made bright.
[0028] Next, TFT202 for current control has the drain wiring 37 in a barrier layer including the source field 31, the drain field 32, the LDD field 33, and the channel formation field 34, gate dielectric film 18, the gate electrode 35, the 1st interlayer insulation film 20, and source wiring 36 list, and is formed in them. In addition, although the gate electrode 35 has single gate structure, you may be multi-gate structure.
[0029] As shown in drawing 2 , the drain of TFT201 for switching is electrically connected to the gate of TFT202 for current control. Specifically, the gate electrode 35 of TFT202 for current control is electrically connected through the drain field 14 of TFT201 for switching, and the drain wiring (said to be connection wiring) 22. Moreover, source wiring 36 is connected to the current supply source line 212.
[0030] The description of this TFT202 for current control is the point that channel width is larger than the channel width of TFT201 for switching. That is, as shown in drawing 8 , when channel length of TFT for switching was set to L1, channel width was set to W1, channel length of TFT for current control is set to L2 and channel width is set to W2, it is made for relational expression called W2/L2 >=5xW1/L1 (preferably W2/L2>=10x W1/L1) to be realized. For this reason, it is possible to pass many currents easily rather than TFT for switching.
[0031] In addition, channel length L1 of TFT for switching which is multi-gate structure is taken as total of each channel length of two or more formed channel formation fields. Since it is double-gate structure in the case of drawing 8 , what added each channel length L1a and L1b of two channel formation fields serves as the channel length L1 of TFT for switching.
[0032] In this invention, although channel length L1 and L2 and channel width W1 and W2 are not limited to the specific numerical range, it is desirable that W1 sets to 0.1-5 micrometers (typically 1-3 micrometers), and W2 sets to 0.5-30 micrometers (typically 2-10 micrometers). At this time, it is desirable that L1 sets to 0.2-18 micrometers (typically 2-15 micrometers), and L2 sets to 0.1-50 micrometers (typically 1-20 micrometers).
[0033] In addition, in TFT for current control, in order to prevent that a current flows superfluously, it is desirable to set up the die length of channel length L for a long time. It is good to be preferably referred to as W2/L2 >=3 (preferably W2/L 2>=5). It is made to be desirably set to 0.5-2microper 1 pixel of ** A (preferably 1-1.5microA).
[0034] Even EL indicating equipment which has the number of pixels of a Hi-Vision class (1920x1080 or 1280x1024) from EL indicating equipment which has the number of pixels of a VGA class (640x480) can cover all specification by considering as these numerical range.
[0035] Moreover, what is necessary is just to set typically to 2.0-2.5 micrometers the 0.5-3.5 micrometers (width of face) of the die length of the LDD field formed in TFT201 for switching.
[0036] Moreover, EL indicating equipment shown in drawing 1 has the description also in the point of having the field where the LDD field 33 was formed between the drain field 32 and the channel formation field 34, and the LDD field 33 has lapped with the gate electrode 35 on both sides of gate dielectric film 18, and the field with which it has not lapped, in TFT202 for current control.
[0037] TFT202 for current control controls the amount of supply, and enables a gradation display at the same time it supplies the current for making EL element 203 emit light. Therefore, it is necessary to take the cure against degradation by hot carrier impregnation so that it may not deteriorate, even if it passes a current. Moreover, in case black is displayed, TFT202 for current control is made into the OFF state, but in that case, if an OFF state current value is high, a beautiful black display will become impossible and the fall of contrast etc. will be caused. Therefore, it is necessary to also hold down an OFF state current value.
[0038] About degradation by hot carrier impregnation, it is known that the structure with which the LDD field lapped to the gate electrode is very effective. However, since an OFF state current value will increase if the whole LDD field is kept in a gate electrode in piles, these people have solved the cure against a hot carrier, and the cure against an OFF state current value to coincidence according to the new structure of establishing the LDD field

which does not lap with a gate electrode in a serial.
[0039] What is necessary is just to set to 0.1-3 micrometers (preferably 0.3-1.5 micrometers) the die length of the LDD field which lapped with the gate electrode at this time. If too long, parasitic capacitance is enlarged, and if too short, the effectiveness of preventing a hot carrier will become weak. Moreover, what is necessary is just to set to 1.0-3.5 micrometers (preferably 1.5-2.0 micrometers) the die length of the LDD field which does not lap with a gate electrode. When too long, it becomes impossible to pass sufficient current, and if too short, the effectiveness of reducing an OFF state current value will become weak.
[0040] Moreover, it is more desirable not to prepare between the source field 31 and the channel formation field 34, since parasitic capacitance will be formed in the field with which the gate electrode and the LDD field lapped in the above-mentioned structure. Since TFT for current control always has the same direction where a carrier (here electron) flows, it is enough if the LDD field is established only in the drain field side.
[0041] Moreover, if the amount of currents which can be passed is seen from a viewpoint of making [many] it, what thickness of the barrier layer (especially channel formation field) of TFT202 for current control is thickened also for (preferably 50-100nm, still more preferably 60-80nm) is effective. On the contrary, in TFT201 for switching, if an OFF state current value is seen from a viewpoint of making it small, what thickness of a barrier layer (especially channel formation field) is made thin also for (preferably 20-50nm, still more preferably 25-40nm) is effective.
[0042] 41 [next,] — the 1st passivation film — it is — thickness — 10nm - 1 micrometer (preferably 200-500nm) — then, it is good. As an ingredient, the insulator layer (the nitriding oxidation silicon film or a silicon nitride film is especially desirable) containing silicon can be used. This passivation film 41 has the role which protects formed TFT from alkali metal or moisture. Alkali metal, such as sodium, is contained in EL layer finally prepared above TFT. That is, the 1st passivation film 41 works also as a protective layer which does not make such alkali metal (movable ion) invade into the TFT side.
[0043] Moreover, it is also effective to prevent the heat deterioration of EL layer by giving the heat dissipation effectiveness to the 1st passivation film 41. However, since, as for EL indicating equipment of the structure of drawing 1 , light is emitted to a substrate 11 side, the 1st passivation film 41 needs to have translucency. Moreover, since it deteriorates by association with oxygen when using an organic material as an EL layer, as for the insulator layer which is easy to emit oxygen, not using is desirable.
[0044] The insulator layer which contains at least one element chosen from B (boron), C (carbon), and N (nitrogen) and at least one element chosen from aluminum (aluminum), Si (silicon), and P (Lynn) as a translucency ingredient with the heat dissipation effectiveness (thermal conductivity is high) is mentioned. For example, it is possible to use the nitride of the aluminum represented by alumimium nitride (AlxNy), the carbide of the silicon represented by silicon carbide (SixCy), the nitride of the silicon represented by silicon nitride (SixNy), the nitride of the boron represented by boron nitride (BxNy), and the phosphide of the boron represented by boron phosphide (BxPy). Moreover, the oxide of the aluminum represented by the aluminum oxide (AlxOy) is excellent in translucency, and thermal conductivity is 20Wm-1K-1, and it can be said to be one of the desirable ingredients. There is not only the heat dissipation effectiveness but effectiveness which prevents invasion of moisture, alkali metal, etc. in these ingredients. In addition, in the above-mentioned translucency ingredient, x and y are the integers of arbitration.
[0045] In addition, other elements are also combinable with the above-mentioned compound. For example, it is also possible to add nitrogen to an aluminum oxide and to use the nitriding aluminum oxide shown by AlNxOy. There is effectiveness which prevents invasion of not only the heat dissipation effectiveness but moisture, alkali metal, etc. also in this ingredient. In addition, in the above-mentioned nitriding aluminum oxide, x and y are the integers of arbitration.
[0046] Moreover, the ingredient indicated by JP,62-90260,A can be used. that is, the insulator layer (however, M — rare earth elements — at least — a kind and at least one element

preferably chosen from Ce (cerium), Yb (ytterbium), Sm (samarium), Er (erbium), Y (yttrium), La (lanthanum), Gd (gadolinium), Dy (dysprosium), and Nd (neodium)) containing Si, aluminum, N, O, and M can also be used. There is effectiveness which prevents invasion of not only the heat dissipation effectiveness but moisture, alkali metal, etc. also in these ingredients.
[0047] Moreover, the carbon film which contains at least a diamond thin film or the amorphous carbon film (especially the thing that has a near property is called diamond-like carbon to a diamond.) can also be used. These have very high thermal conductivity and are very effective as a heat dissipation layer. However, since brown will be worn and permeability will fall if thickness becomes thick, it is desirable to use by as thin thickness (preferably 5-100nm) as possible.
[0048] In addition, since it is in the purpose of the 1st passivation film 41 protecting TFT from alkali metal or moisture to the last, don't spoil the effectiveness. Therefore, although the thin film which consists of an ingredient with the above-mentioned heat dissipation effectiveness can also be used alone, it is effective to carry out the laminating of these thin films and the thin film (typically a silicon nitride film (SixNy) and nitriding oxidation silicon film (SiOxNy)) which has the property which intercepts alkali metal and moisture. In addition, in the above-mentioned silicon nitride film or the nitriding oxidation silicon film, x and y are the integers of arbitration.
[0049] Moreover, 42 is a color filter and 43 is a fluorescent substance (it is also called a fluorescence pigment layer). In the combination of the same color, both contain the coloring matter of red (R), green (G), or blue (B). It prepares, in order that a color filter 42 may raise color purity, and a fluorescent substance 43 is formed in order to perform color conversion.
[0050] In addition, the method which combined the method which it roughly divides into EL display, and there are four colorization means of displaying, and forms three kinds of EL elements corresponding to RGB, the method which combined the EL element and color filter of white luminescence, blue, or the EL element and fluorescent substance (the color conversion layer of fluorescence: CCM) of bluish green luminescence, the method which puts the EL element corresponding to RGB on cathode (counterelectrode) using a transparent electrode, ******.
[0051] The structure of drawing 1 is an example at the time of using the method which combined the EL element and fluorescent substance of blue luminescence. Here, light with the wavelength of the blue field which contains ultraviolet radiation, using the luminous layer of blue luminescence as EL element 203 is formed, by the light, a fluorescent substance 43 is excited and the light of red, green, or blue is generated. And color purity is raised and outputted with a color filter 42.
[0052] However, it is not concerned with a luminescence method, but this invention can be carried out, and can use all the four above-mentioned methods for this invention.
[0053] Moreover, after forming a color filter 42 and a fluorescent substance 43, the 2nd interlayer insulation film 44 performs flattening. As the 2nd interlayer insulation film 44, the resin film is desirable and it is good to use polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. Of course, the inorganic film may be used as long as sufficient flattening is possible.
[0054] It is very important to carry out flattening of the level difference by TFT with the 2nd interlayer insulation film 44. Since EL layer formed behind is very thin, poor luminescence may be caused when a level difference exists. Therefore, before forming a pixel electrode so that EL layer can be formed as much as possible in a flat side, it is desirable to carry out flattening.
[0055] Moreover, 45 is the 2nd passivation film (the implications as a heat dissipation layer are strong), and 5nm - 1 micrometer (typically 20-300nm) of thickness is desirable. It functions as this 2nd passivation film 45 being formed in contact with an EL element, missing the heat generated in the EL element, and heat not accumulating it in an EL element. Moreover, since it is weak with heat when the 2nd interlayer insulation film 44 is resin film, it is made for the heat generated in the EL element not to have a bad influence on the 2nd interlayer insulation film 44.

[0056] In producing EL display as mentioned above, it was effective to have carried out flattening of the TFT by the resin film, but the structure in consideration of degradation of the resin film by the heat generated in the EL element did not have the former. In this invention, the point which has solved the point can also be said to be one of the descriptions by forming the 2nd passivation film 45.

[0057] Moreover, the 2nd passivation film 45 functions also as a protective layer for making it the alkali metal in EL layer not spread to the TFT side, and functions also as a protective layer by which it is made for neither moisture nor oxygen to invade into EL layer side from the TFT side further at the same time it prevents degradation by the above-mentioned heat.

[0058] The ingredient same as an ingredient of this 2nd passivation film 45 as the ingredient which can be used for the 1st passivation film 41 can be used. As a high ingredient of especially the heat dissipation effectiveness, carbon films, such as diamond film or diamond-like carbon film, are desirable, and in order to prevent invasion of moisture etc., it is still more desirable to use the laminated structure of a carbon film and a silicon nitride film (or nitriding oxidation silicon film).

[0059] Thus, it can be said that the point of the heat dissipation effectiveness being high in a TFT and EL element side, and dissociating by the insulator layer which can intercept moisture and alkali metal is one of the important descriptions of this invention, and is the configuration which is not in the conventional EL display.

[0060] Moreover, 46 is a pixel electrode (anode plate of an EL element) which becomes by the transparence electric conduction film, and after it opens a contact hole in the 2nd passivation film 45, the 2nd interlayer insulation film 44, and the 1st passivation film 41, it is formed so that it may connect with the drain wiring 37 of TFT202 for current control.

[0061] On the pixel electrode 46, the EL layer (an organic material is desirable) 47, cathode 48, and the protection electrode 49 are formed one by one. Although the EL layer 47 is used by the monolayer or the laminated structure, it is used by the laminated structure in many cases. Although various laminated structures are proposed combining a luminous layer, the electronic transportation layer, the electron injection layer, the hole-injection layer, or the electron hole transportation layer, in this invention, you may be which structure. Of course, fluorescence coloring matter etc. may be doped to EL layer. Moreover, in this specification, the light emitting device formed in a pixel electrode (anode plate), EL layer, and cathode is called an EL element.

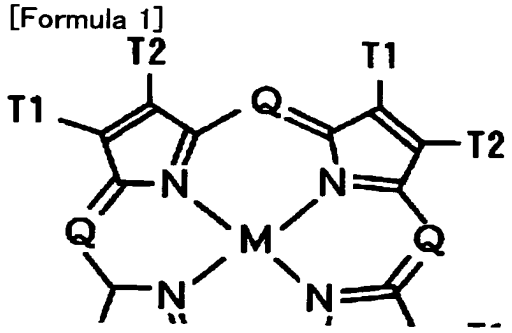
[0062] In this invention, all well-known EL ingredients can already be used. When the organic material is known widely and driver voltage is taken into consideration as a well-known ingredient, it is desirable to use an organic material. As an organic electroluminescence ingredient, the ingredient indicated by the following United States patents or open official reports can be used, for example.

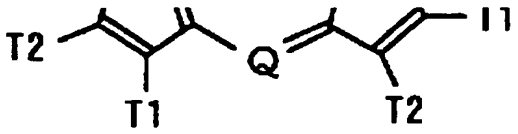
[0063] U.S. Pat. No. 4,356,429 U.S. Pat. No. 4,539,507, U.S. Pat. No. 4,720,432 U.S. Pat. No. 4,769,292, U.S. Pat. No. 4,885,211 U.S. Pat. No. 4,950,950, U.S. Pat. No. 5,059,861 U.S. Pat. No. 5,047,687, U.S. Pat. No. 5,073,446 U.S. Pat. No. 5,059,862, U.S. Pat. No. 5,061,617 U.S. Pat. No. 5,151,629 U.S. Pat. No. 5,294,869 U.S. Pat. No. 5,294,870, JP,10-189252,A, JP,8-241048,A, JP,8-78159,A.

[0064] Specifically, the organic material as a hole-injection layer can use what is expressed with the following general formulas.

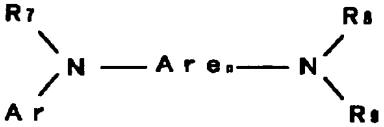
[0065]

[Formula 1]

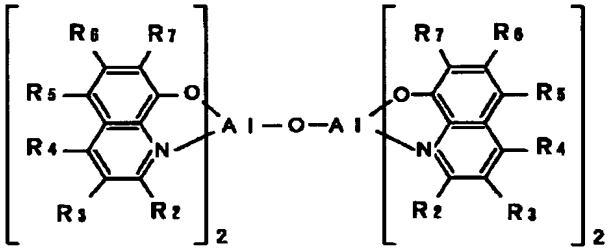




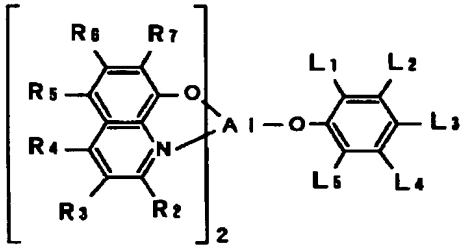
[0066] Q is N or C-R (chain) here, M is a metal, a metallic oxide, or a metal halogenide, R is hydrogen, alkyl, an aralkyl, an allyl compound, or Al Khalil, and T1 and T2 are the partial saturation six membered rings containing hydrogen, alkyl, or a substituent like a halogen.
[0067] Moreover, the organic material as an electron hole transportation layer can use an aromatic series tertiary amine, and contains the tetra-allyl compound diamine preferably expressed with the following general formulas.
[0068]
[Formula 2]



[0069] Are is a propine group here, n is the integer of 1 to 4, and Ar, R7, R8, and R9 are the selected allyl compound groups, respectively.
[0070] Moreover, the organic material as EL layer, an electronic transportation layer, or an electron injection layer can use a metal oxy-NOIDO compound. What is necessary is just to use what is expressed with the following general formulas as a metal oxy-NOIDO compound.
[0071]
[Formula 3]

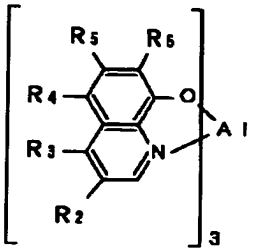


[0072] R2-R7 can be replaced and they can also use the following metal oxy-NOIDO compounds here.
[0073]
[Formula 4]



[0074] R2-R7 are based on an above-mentioned definition here, and L1-L5 are a carbohydrate group containing the carbon element of 1 to 12, and both L1 and L2, and L2 and L3 can form a benzo ring. Moreover, the following metal oxy-NOIDO compounds are sufficient.

[0075]
[Formula 5]



[0076] R2-R6 can be replaced here. Thus, the coordination compound which has organic ligand as an organic electroluminescence ingredient is included. However, the above example is an example of the organic electroluminescence ingredient which can be used as an EL ingredient of this invention, and there is no need of limiting to this.
[0077] Moreover, when using an ink jet method as the formation approach of EL layer, as an EL ingredient, a polymer system ingredient is desirable. As a typical polymer system ingredient, polymeric materials, such as a poly para-phenylene vinylene (PPV) system and the poly fluorene system, are mentioned. In order to colorize, to red luminescent material, polyphenylene vinylene and the poly alkyl phenylene are [cyano polyphenylene vinylene and green luminescent material / polyphenylene vinylene and blue luminescent material] desirable. All the ingredients indicated by JP,10-012377,A can be quoted about the organic electroluminescence ingredient which can be used for the ink jet method.
[0078] Moreover, the ingredient which contains the small magnesium (Mg), the lithium (Li), the caesium (Cs), the barium (Ba), the potassium (K), beryllium (Be), or calcium (calcium) of a work function as cathode 48 is used. What is necessary is just to use the electrode which becomes preferably by MgAg (ingredient which mixed Mg and aluminum by Mg:Ag=10:1). A MgAgAl electrode, a LiAl electrode, and a LiFAl electrode are mentioned to others. Moreover, it is the electrode prepared in order that the protection electrode 49 may carry out the protective coat of the cathode 48 from external moisture etc., and the ingredient containing aluminum (aluminum) or silver (Ag) is used. There is the heat dissipation effectiveness in this protection electrode 49.
[0079] In addition, as for the EL layer 47 and cathode 48, it is desirable to carry out continuation formation, without carrying out atmospheric-air release. Namely, no matter EL layer and cathode may be what laminated structures, it is desirable to carry out continuation formation altogether with the membrane formation equipment of a multi chamber (it is also called cluster tool) method. When using an organic material as an EL layer, since it is very weak for moisture, this is for avoiding the moisture absorption when carrying out atmospheric-air release. Furthermore, even the EL layer 47 and not only the cathode 48 but the protection electrode 49 on it is still better to carry out continuation formation.
[0080] Although vacuum evaporation technique (especially organic molecular-beam vacuum deposition is effective when forming the super-thin film of molecule order level.), a spatter, a plasma-CVD method, a spin coating method, screen-stencil, or the ion plating method has desirable EL layer to heat as the membrane formation approach since it is very weak, forming by the ink jet method is also possible. Although there are Bubble Jet (JP,5-116297,A etc.) which uses cavitation, and piezo methods (JP,8-290647,A etc.) using a piezo-electric element as ink jet method, a piezo method is desirable if an organic electroluminescence ingredient takes an example by heat in a weak thing.
[0081] 50 [moreover,] — the 3rd passivation film — it is — thickness — 10nm - 1 micrometer (preferably 200-500nm) — then, it is good. Although the purpose which forms the 3rd passivation film 50 has the main purpose which protects the EL layer 47 from moisture, it may give the heat dissipation effectiveness like the 2nd passivation film 45. Therefore, the thing same as a formation ingredient as the 1st passivation film 41 can be used. However, since it may deteriorate by association with oxygen when using an organic material as an EL layer 47, as for the insulator layer which is easy to emit oxygen, not using is desirable.
[0082] Moreover, since EL layer is weak with heat as mentioned above, it is desirable to form membranes if possible at low temperature (preferably temperature requirement from a room

temperature to 120 degrees C). Therefore, it can be said to be the membrane formation approach that a plasma-CVD method, a spatter, vacuum evaporation technique, the ion plating method, or the solution applying method (spin coating method) is desirable.
[0083] Thus, although forming the 2nd passivation film 45 can also fully control degradation of an EL element, an EL element is surrounded still more preferably by the insulator layer of the bilayer formed on both sides of the EL element like the 2nd passivation film 45 and the 3rd passivation film 50, invasion of the moisture to EL layer and oxygen is prevented, diffusion of the alkali metal from EL layer is prevented, and are recording of the heat to EL layer is prevented. Consequently, degradation of EL layer is controlled further and reliable EL display is obtained.
[0084] Moreover, EL display of this invention has the pixel section which consists of a pixel of structure like drawing 1 , and TFT from which structure differs according to a function in a pixel is arranged. TFT for switching of an OFF state current value low enough and TFT for current control strong against hot carrier impregnation can form in the same pixel by this, it has high dependability and EL display in which good image display is possible (the engine performance of operation is high) is obtained.
[0085] In addition, although TFT of multi-gate structure is used as TFT for switching in the pixel structure of drawing 1 , it is not necessary to limit to the configuration of drawing 1 about the configuration of arrangement of a LDD field etc.
[0086] Suppose that still more detailed explanation is given about this invention which becomes with the above configuration as it is also at the example shown below.
[0087] [Example 1] The example of this invention is explained using drawing 3 - drawing 5 . Here, how to produce to coincidence TFT of the pixel section and the drive circuit section prepared around it is explained. However, in order to simplify explanation, suppose that the CMOS circuit which is a basic circuit is illustrated about a drive circuit.
[0088] First, as shown in drawing 3 (A), the substrate film 301 is formed on a glass substrate 300 at the thickness of 300nm. In this example, as substrate film 301, the laminating of the nitriding oxidation silicon film is carried out, and it is used. At this time, it is good to make into 10 - 25wt% nitrogen concentration of the direction which touches a glass substrate 300.
[0089] Moreover, it is effective to prepare the insulator layer which consists of the ingredient same as some substrate film 301 as the 1st passivation film 41 shown in drawing 1 . It is effective to prepare the insulator layer which is easy to generate heat since TFT for current control will pass a high current, and has the heat dissipation effectiveness in as near a place as possible.
[0090] Next, the amorphous silicon film (not shown) with a thickness of 50nm is formed by the well-known forming-membranes method on the substrate film 301. In addition, what is necessary is just the semi-conductor film (the microcrystal semi-conductor film is included) which does not need to limit to the amorphous silicon film and includes amorphous structure. The compound semiconductor film which furthermore includes the amorphous structure of the amorphous silicon germanium film etc. is sufficient. Moreover, thickness should just be 20-100nm in thickness.
[0091] And the amorphous silicon film is crystallized with a well-known technique, and the crystalline substance silicon film (it is also called the polycrystalline silicon film or the polish recon film) 302 is formed. As the well-known crystallization approach, there are the heat crystallization approach which used the electric heat furnace, a laser annealing crystallizing method using laser light, and the lamp annealing crystallizing method using infrared light. In this example, it crystallizes using the excimer laser light which used XeCl gas.
[0092] In addition, although the excimer laser light of the pulse oscillation mold processed into the line is used in this example, you may be a rectangle and the argon laser light of a continuous-oscillation mold and the excimer laser light of a continuous-oscillation mold can also be used.
[0093] Although the crystalline substance silicon film is used as a barrier layer of TFT in this example, it is also possible to use the amorphous silicon film. However, it is more advantageous to use a sink and the cone crystalline substance silicon film for a current, since

TFT for current control has the need of passing a high current.
[0094] In addition, it is effective to form the barrier layer of TFT for switching with the need of reducing the OFF state current, by the amorphous silicon film, and to form the barrier layer of TFT for current control by the crystalline substance silicon film. Since the amorphous silicon film has low carrier mobility, the OFF state current cannot flow easily that it is hard to pass a current. That is, the advantage of both sink or cone crystalline substance silicon film can be efficiently employed [a current] for the pile amorphous silicon film and a current in a sink.
[0095] Next, as shown in drawing 3 (B), the protective coat 303 which becomes by the oxidation silicon film is formed on the crystalline substance silicon film 302 at the thickness of 130nm. What is necessary is just to choose this thickness in 100-200nm (preferably 130-170nm). Moreover, other film is sufficient as long as it is an insulator layer containing silicon. This protective coat 303 is formed in order to enable concentration control delicate in order not to put the crystalline substance silicon film to the direct plasma, in case an impurity is added.
[0096] And the resist masks 304a and 304b are formed on it, and the impurity element (henceforth n mold impurity element) which gives n mold through a protective coat 303 is added. In addition, Lynn or arsenic can be used for the element and type target which belong to 15 groups typically as an n mold impurity element. In addition, in this example, Lynn is added by the concentration of 1x1018 atoms/cm3 using the plasma doping method which carried out plasma excitation without carrying out mass separation of the phosphoretted hydrogen (PH3). Of course, the ion implantation method for performing mass separation may be used.
[0097] In n mold impurity ranges 305 and 306 formed of this process, a dose is adjusted so that n mold impurity element may be contained by the concentration of 2x1016 - 5x1019 atoms/cm3 (typically 5x1017 - 5x1018 atoms/cm3).
[0098] Next, as shown in drawing 3 (C), the element which removes a protective coat 303 and belongs to 15 groups who added is activated. Although an activation means should just use a well-known technique, it is activated by the exposure of excimer laser light by this example. Of course, a pulse oscillation mold or a continuous-oscillation mold may be used, and it is not necessary to limit to excimer laser light. However, since activation of the added impurity element is the purpose, it is desirable to irradiate with the energy which is extent which the crystalline substance silicon film does not fuse. In addition, laser light may be irradiated, with the protective coat 303 attached.
[0099] In addition, activation by heat treatment may be used together on the occasion of activation of the impurity element by this laser light. What is necessary is just to perform heat treatment of about 450-550 degrees C in consideration of the thermal resistance of a substrate, when performing activation by heat treatment.
[0100] The boundary section (joint) with the field which has not added n mold impurity element which exists in the edge of n mold impurity ranges 305 and 306, i.e., the perimeter of n mold impurity ranges 305 and 306, according to this process becomes clear. This means that a LDD field and a channel formation field can form a very good joint, when TFT is completed behind.
[0101] Next, as shown in drawing 3 (D), the unnecessary part of the crystalline substance silicon film is removed, and the island-like semi-conductor film (henceforth a barrier layer) 307-310 is formed.
[0102] Next, as shown in drawing 3 (E), barrier layers 307-310 are covered and gate dielectric film 311 is formed. What is necessary is just to use 10-200nm of insulator layers which contain silicon with a thickness of 50-150nm preferably as gate dielectric film 311. Monolayer structure or a laminated structure is sufficient as this. In this example, the nitriding oxidation silicon film of 110nm thickness is used.
[0103] Next, patterning of the electric conduction film of 200-400nm thickness is formed and carried out, and the gate electrodes 312-316 are formed. In addition, in this example, a gate electrode and wiring for leading about electrically connected to the gate electrode (henceforth

gate wiring) are formed with another ingredient. concrete -- a gate electrode -- low -- an ingredient [****] is used as gate wiring. Even if micro processing of this is impossible for gate wiring using the ingredient in which micro processing is possible as a gate electrode, it is for wiring resistance to use a small ingredient. Of course, a gate electrode and gate wiring may be formed with the same ingredient.

[0104] Moreover, although a gate electrode may be formed by the electric conduction film of a monolayer, it is desirable to consider as cascade screens, such as a bilayer and three layers, if needed. All electric conduction film well-known as an ingredient of a gate electrode can be used. However, the ingredient in which patterning is possible in line breadth of 2 micrometers or less is possible [micro processing] as mentioned above and specifically desirable.

[0105] Typically A tantalum (Ta), titanium (Ti), molybdenum (Mo), The film which becomes by the element chosen from a tungsten (W) or chromium (Cr), or the nitride film (typical -- the tantalum nitride film and the nitriding tungsten film --) of said element The silicon film which gave the titanium nitride film, the alloy film (typically a Mo-W alloy, a Mo-Ta alloy) which combined said element, the silicide film (typically tungsten silicide film, titanium silicide film) of said element, or conductivity can be used. Of course, it may use by the monolayer, or a laminating may be carried out and you may use.

[0106] In this example, the cascade screen which becomes by the tantalum nitride (TaN) film of 50nm thickness and Ta film of 350nm thickness is used. What is necessary is just to form this by the spatter. Moreover, if inert gas, such as Xe and Ne, is added as sputtering gas, film peeling by stress can be prevented.

[0107] Moreover, at this time, the gate electrodes 313 and 316 are formed so that it may lap through gate dielectric film 311 with a part of n mold impurity ranges 305 and 306, respectively. This overlapping part serves as a LDD field which lapped with the gate electrode behind.

[0108] Next, as shown in drawing 4 (A), n mold impurity element (this example Lynn) is added in self align by using the gate electrodes 312-316 as a mask. In this way, in the impurity ranges 317-323 formed, it adjusts so that Lynn may be added by the concentration of 1 / 2 - 1/10 of n mold impurity ranges 305 and 306 (typically 1 / 3 - 1/4). Specifically, the concentration of 1x1016 - 5x1018 atoms/cm3 (typically 3x1017 - 3x1018 atoms/cm3) is desirable.

[0109] Next, as shown in drawing 4 (B), the resist masks 324a-324d are formed for a gate electrode etc. in a wrap form, and the impurity ranges 325-331 which add n mold impurity element (this example Lynn), and include Lynn in high concentration are formed. It carries out by the ion doping method for having used phosphoretted hydrogen (PH3) also here, and the concentration of Lynn of this field is adjusted so that it may become 1x1020 - 1x1021 atoms/cm3 (typically 2x1020 - 5x1020 atoms/cm3).

[0110] Although the source field or drain field of the n channel mold TFT is formed of this process, in TFT for switching, it leaves a part of n mold impurity ranges 320-322 formed at the process of drawing 4 (A). This left-behind field is equivalent to the LDD fields 15a-15d of TFT for switching in drawing 1 .

[0111] Next, as shown in drawing 4 (C), the resist masks 324a-324d are removed, and the resist mask 332 is newly formed. And p mold impurity element (this example boron) is added, and the impurity ranges 333 and 334 which contain boron in high concentration are formed. Here, boron is added so that it may become 3x1020 - 3x1021 atoms/cm3 (typically 5x1020 - 1x1021 atoms/cm3) concentration by the ion doping method for having used diboron hexahydride (B-2 H6).

[0112] In addition, although Lynn is already added by impurity ranges 333 and 334 by the concentration of 1x1016 - 5x1018 atoms/cm3, the boron added here is added by the concentration of at least 3 times or more. Therefore, it is completely reversed to P type, and the impurity range of n mold currently formed beforehand functions as an impurity range of P type.

[0113] Next, after removing the resist mask 332, n mold or p mold impurity element added by

each concentration is activated. As an activation means, it can carry out by the furnace annealing method, the laser annealing method, or the lamp annealing method. In this example, 550 degrees C and heat treatment of 4 hours are performed among nitrogen-gas-atmosphere mind in an electric heat furnace.

[0114] It is important to eliminate the oxygen in an ambient atmosphere as much as possible at this time. It is because it is hard coming to take ohmic contact behind while the front face of the gate electrode exposed when oxygen existed oxidizes and causing the increment in resistance. Therefore, as for the oxygen density in the processing ambient atmosphere in the above-mentioned activation process, it is preferably desirable to be referred to as 0.1 ppm or less 1 ppm or less.

[0115] Next, if an activation process is completed, the gate wiring 335 of 300nm thickness will be formed. What is necessary is just to use the metal membrane which uses aluminum (aluminum) or copper (Cu) as a principal component (it considers as a presentation and 50 - 100% is occupied.) as an ingredient of the gate wiring 335. Like the gate wiring 211 of drawing 2 as arrangement, it forms so that the gate electrodes 314 and 315 (it is equivalent to the gate electrodes 19a and 19b of drawing 2) of TFT for switching may be connected electrically. (Drawing 4 (D))

[0116] Since wiring resistance of gate wiring can be made very small by considering as such structure, the image display field (pixel section) where area is large can be formed. That is, when the magnitude of a screen realizes EL display of 10 inches or more (30 more inches or more) of vertical angles, the pixel structure of this example is very effective.

[0117] Next, as shown in drawing 5 (A), the 1st interlayer insulation film 336 is formed. What is necessary is just to use the cascade screen which used the insulator layer containing silicon by the monolayer as the 1st interlayer insulation film 336, or was combined in it. Moreover, thickness is just 400nm - 1.5 micrometers. In this example, it considers as the structure which carried out the laminating of the oxidation silicon film of 800nm thickness on the nitriding oxidation silicon film of 200nm thickness.

[0118] Furthermore, in the ambient atmosphere containing 3 - 100% of hydrogen, heat treatment of 1 - 12 hours is performed at 300-450 degrees C, and a hydrogen treating is performed. This process is a process which carries out hydrogen termination of the azygos joint hand of the semi-conductor film by the hydrogen excited thermally. As other means of hydrogenation, plasma hydrogenation (the hydrogen excited by the plasma is used) may be performed.

[0119] In addition, a hydrogen treating may be put in while forming the 1st interlayer insulation film 336. That is, after forming the nitriding oxidation silicon film of 200nm thickness, a hydrogen treating may be performed as mentioned above, and it may remain after that, and the oxidation silicon film of 800nm thickness may be formed.

[0120] Next, a contact hole is formed to the 1st interlayer insulation film 336, and source wiring 337-340 and the drain wiring 341-343 are formed. In addition, in this example, it considers as the cascade screen of the three-tiered structure which carried out the aluminum film which contains [this electrode] 100nm and titanium for the titanium film by 300nm, and carried out continuation formation of the 150nm of the titanium film by the spatter. Of course, other electric conduction film is sufficient and the alloy film containing silver, palladium, and copper may be used.

[0121] Next, the 1st passivation film 344 is formed by the thickness of 50-500nm (typically 200-300nm). In this example, the nitriding oxidation silicon film of 300nm thickness is used as the 1st passivation film 344. A silicon nitride film may be substituted for this. Of course, it is possible to use the same ingredient as the 1st passivation film 41 of drawing 1 .

[0122] In addition, it is effective to perform plasma treatment using the gas which contains H2 and NH3 grade hydrogen in advance of formation of the nitriding oxidation silicon film. The membraneous quality of the 1st passivation film 344 is improved because the hydrogen excited by this pretreatment heat-treats by supplying the 1st interlayer insulation film 336. Since the hydrogen added by the 1st interlayer insulation film 336 at it and coincidence is spread in a lower layer side, a barrier layer can be hydrogenated effectively.

[0123] Next, as shown in drawing 5 (B), a color filter 345 and a fluorescent substance 346 are formed. These ingredients should just use a well-known thing. Moreover, patterning may be carried out separately and you may form, and these are formed continuously, and by package, patterning of them may be carried out and they may be formed. Moreover, what is necessary is just to use screen printing, the ink jet method, mask vacuum deposition (how to form alternatively using mask material), etc. as the formation approach.
[0124] Each thickness is chosen in 0.5-5 micrometers (typically 1-2 micrometers). The optimal thickness changes with ingredients which use especially the fluorescent substance 346. That is, if too thin, color conversion efficiency will worsen, if too thick, a level difference turns large up and the amount of transmitted lights of light will fall off. Therefore, the optimal thickness must be determined on the balance of both properties.
[0125] In addition, although this example explains the light generated from EL layer taking the case of the colorization method which carries out color conversion, when adopting the method which produces EL layer corresponding to RGB according to an individual, a color filter and a fluorescent substance can also be omitted.
[0126] Next, the 2nd interlayer insulation film 347 which consists of resin is formed. As resin, polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. can be used. Since especially the 2nd interlayer insulation film 347 has the strong implications of flattening, its acrylic excellent in surface smoothness is desirable. At this example, the acrylic film is formed by the thickness which can fully carry out flattening of the level difference of a color filter 345 and a fluorescent substance 346. desirable -- 1-5 micrometers (still more preferably 2-4 micrometers) -- then, it is good.
[0127] Next, the 2nd passivation film 348 of 100nm thickness is formed on the 2nd interlayer insulation film 347. In this example, the insulator layer containing Si, aluminum, N, O, and La is used. And the contact hole which reaches the drain wiring 343 is formed in the 2nd passivation film 348, the 2nd interlayer insulation film 347, and the 1st passivation film 344, and the pixel electrode 349 is formed. In this example, the compound (ITO) film of indium oxide and the tin oxide is formed in the thickness of 110nm, patterning is performed, and it considers as a pixel electrode. This pixel electrode 349 turns into an anode plate of an EL element. In addition, it is also possible to use the zinc-oxide film containing the compound film and oxidation gallium of indium oxide and a zinc oxide as other ingredients.
[0128] In addition, in this example, it has the structure where the pixel electrode 349 was electrically connected to the drain field 331 of TFT for current control through the drain wiring 343. There are the following advantages in this structure.
[0129] Since the pixel electrode 349 will touch organic materials, such as EL layer (luminous layer) and a charge transportation layer, directly, the movable ion contained in EL layer etc. may diffuse the inside of a pixel electrode. That is, the structure of this example cannot connect the pixel electrode 349 to the drain field 331 which is a part of direct barrier layer, but can prevent invasion of the movable ion to the inside of a barrier layer by relaying the drain wiring 343.
[0130] Next, continuation formation is carried out without carrying out atmospheric-air release of the EL layer 350, cathode (MgAg electrode) 351, and the protection electrode 352, as shown in drawing 5 (C). It is desirable to precede to form the EL layer 350 and cathode 351 at this time, to heat-treat to the pixel electrode 349, and to remove moisture completely. In addition, an ingredient well-known as an EL layer 350 can be used.
[0131] In addition, as an EL layer 350, it is [Embodiment of the Invention]. The ingredient explained by **** can be used. Although 4 layer structures which become in a hole-injection layer (Hole injecting layer), an electron hole transportation layer (Hole transporting layer), a luminous layer (Emitting layer), and an electronic transportation layer (Electron transporting layer) are used as EL layer in this example as shown in drawing 19 , an electronic transportation layer may not be prepared and an electron injection layer may be prepared. Moreover, a hole-injection layer may be omitted. Thus, various examples are already reported and combination may use which the configuration.
[0132] A hydrazone system (typically DEH), a stilbene system (typically STB), a star bust

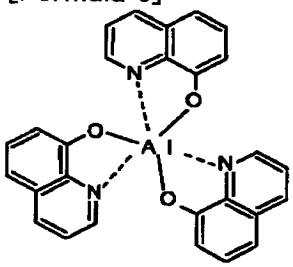
system (typically m-MTDATA), etc. can be used for others that what is necessary is just to use TPD (triphenylamine derivative) of an amine system as a hole-injection layer or an electron hole transportation layer. The star bust system ingredient which especially glass transition temperature cannot crystalize easily highly is desirable. Moreover, the poly aniline (PAni), the poly thiophene (PEDOT), or a copper phthalocyanine (CuPc) may be used.

[0133] although BPPC, perylene, and DCM can use as a red luminous layer as a luminous layer, Eu complex (J. — Kido et.al, Appl.Phys., vol.35, and pp.L394- detailed to 396 and 1996.) shown especially by Eu (DBM)3 (Phen) has high monochromaticity with luminescence sharp in wavelength of 620nm.

[0134] Moreover, the ingredient which added several mol % of Quinacridone or, and a coumarin can be typically used for Alq3 (8-hydroxyquinoline alminium) as a green luminous layer. A chemical formula is as follows.

[0135]

[Formula 6]

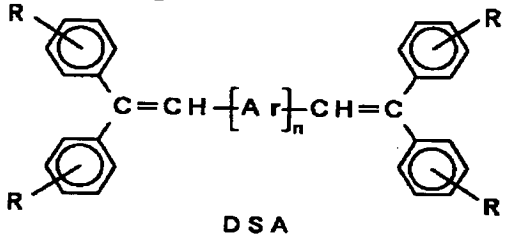


Alq3

[0136] Moreover, the JISUCHIRU arylene amine derivative which added the amino permutation DSA can be typically used for DSA (JISUCHIRU arylene derivative) as a blue luminous layer. It is desirable to use especially the JISUCHIRI ruby phenyl (DPVBi) which is an ingredient with the high engine performance. A chemical formula is as follows.

[0137]

[Formula 7]



DSA

[0138] Moreover, although it is possible for the protection electrode 352 to also protect the EL layer 350 from moisture or oxygen, it is good to form the 3rd passivation film 353 still more preferably. In this example, the silicon nitride film of 300nm thickness is prepared as the 3rd passivation film 353. You may form continuously without this 3rd passivation film's also carrying out atmospheric-air release after the protection electrode 352. Of course, as the 3rd passivation film 353, the same ingredient as the 3rd passivation film 50 of drawing 1 can be used.

[0139] Although 4 layer structures which become in a hole-injection layer, an electron hole transportation layer, a luminous layer, and an electron injection layer are used as EL layer in this example, various examples are already reported and combination may use which the configuration. Moreover, although a MgAg electrode is used as cathode of an EL element in this example, you may be other well-known ingredients.

[0140] Moreover, the protection electrode 352 has the typical metal membrane which is prepared in order to prevent degradation of the MgAg electrode 351, and uses aluminum as a principal component. Of course, other ingredients are sufficient. Moreover, since the EL layer 350 and the MgAg electrode 351 are very weak for moisture, it is desirable to form continuously without carrying out atmospheric-air release even of the protection electrode

352, and to protect EL layer from the open air.
[0141] In addition, what is necessary is just to set to 180-300nm (typically 200-250nm) thickness whose thickness of the EL layer 350 is 10-400nm (typically 60-160nm) and the MgAg electrode 351.
[0142] In this way, the active-matrix mold EL display of structure as shown in drawing 5 (C) is completed. By the way, by arranging TFT of the optimal structure not only for the pixel section but the drive circuit section, the active-matrix mold EL display of this example shows very high dependability, and its operating characteristic may also improve.
[0143] First, TFT which has the structure of reducing hot carrier impregnation so that a working speed may not be reduced as much as possible is used as an n channel mold TFT205 of the CMOS circuit which forms a drive circuit. In addition, as a drive circuit here, a shift register, a buffer, a level shifter, a sampling circuit (transfer gate), etc. are included. In performing a digital drive, signal transformation circuits, such as a D/A converter, are also included and it gets.
[0144] In the case of this example, as shown in drawing 5 (C), in the LDD field 357, the barrier layer of the n channel mold 205 has lapped with the gate electrode 313 on both sides of gate dielectric film 311 including the source field 355, the drain field 356, the LDD field 357, and the channel formation field 358.
[0145] The consideration for not reducing a working speed forms the LDD field only in a drain field side. Moreover, it is better for this n channel mold TFT205 to seldom have cared about the OFF state current value, and to attach greater importance than to it to a working speed. Therefore, as for the LDD field 357, it is desirable to keep in a gate electrode in piles completely, and to lessen a resistance component as much as possible. Namely, it is better to abolish the so-called offset.
[0146] Moreover, since degradation by hot carrier impregnation hardly worries the p channel mold TFT206 of a CMOS circuit, it is not necessary to prepare especially a LDD field. Of course, it is also possible to prepare a LDD field like the n channel mold TFT205, and to take the cure against a hot carrier.
[0147] In addition, also in a drive circuit, a sampling circuit is a particular for a while compared with other circuits, and a high current flows a channel formation field bidirectionally. That is, the role of a source field and a drain field interchanges. Furthermore, it is desirable to arrange TFT which needs to hold down an OFF state current value low as much as possible, and has the function of middle extent of TFT for switching and TFT for current control in such semantics.
[0148] Therefore, as for the n channel mold TFT which forms a sampling circuit, it is desirable to arrange TFT of structure as shown in drawing 9 . As shown in drawing 9 , a part of LDD fields 901a and 901b lap with the gate electrode 903 on both sides of gate dielectric film 902. This effectiveness is as explanation of TFT202 for current control having described, and, in the case of a sampling circuit, it differs in that the LDD fields 901a and 901b are formed in the form which faces across the channel formation field 904.
[0149] Moreover, the pixel of structure as shown in drawing 1 is formed, and the pixel section is formed. About the structure of TFT for switching formed in a pixel, and TFT for current control, since drawing 1 already explained, explanation here is omitted.
[0150] In addition, when completing to drawing 5 (C) in fact, it is desirable to carry out packaging (enclosure) by housing material, such as airtight high protection films (a laminate film, ultraviolet-rays hardening resin film, etc.) and a sealing can made from the ceramics, so that it may not be further put to the open air. In that case, the interior of housing material is made into an inert atmosphere, or the dependability (life) of EL layer improves by arranging a hygroscopic material (for example, barium oxide) inside.
[0151] Moreover, if processing of packaging etc. raises airtightness, the connector (flexible print circuit: FPC) for connecting the terminal and external signal terminal which were taken about from the component formed on the substrate or the circuit will be attached, and it will complete as a product. EL indicating equipment changed into such a condition that it can ship is called EL module in this specification.

[0152] The configuration of the active-matrix mold EL display of this example is explained here using the perspective view of drawing 6 . The active-matrix mold EL display of this example consists of the pixel section 602 formed on the glass substrate 601, a gate side drive circuit 603, and a source side drive circuit 604. TFT605 for switching of the pixel section is the n channel mold TFT, and is arranged at the intersection of the gate wiring 606 connected to the gate side drive circuit 603, and the source wiring 607 connected to the source side drive circuit 604. Moreover, the drain of TFT605 for switching is electrically connected to the gate of TFT608 for current control.

[0153] Furthermore, the source of TFT608 for current control is connected to the current supply source line 609, and EL element 610 is electrically connected to the drain of TFT608 for current control. At this time, if TFT608 for current control is the n channel mold TFT, it is desirable that the anode plate of EL element 610 is connected to that drain. Moreover, if TFT608 for current control is the p channel mold TFT, it is desirable that the cathode of EL element 610 is connected to the drain.

[0154] And the input wiring (connection wiring) 612 and 613 for transmitting a signal to a drive circuit and the input wiring 614 connected to the current supply source line 609 are formed in FPC611 used as an external input terminal.

[0155] Moreover, an example of the circuitry of EL display shown in drawing 6 is shown in drawing 7 . this example -- EL -- a display -- the source -- a side -- a drive -- a circuit -- 701 -- the gate -- a side -- a drive -- a circuit -- (-- A --) -- 707 -- the gate -- a side -- a drive -- a circuit -- (-- B --) -- 711 -- a pixel -- the section -- 706 -- having -- **** . In addition, it is the generic name with which the drive circuit included the source side drive circuit and the gate side drive circuit into this specification.

[0156] The source side drive circuit 701 is equipped with the shift register 702, the level shifter 703, the buffer 704, and the sampling circuit (sample and hold circuit) 705. Moreover, the gate side drive circuit (A) 707 is equipped with the shift register 708, the level shifter 709, and the buffer 710. The gate side drive circuit (B) 711 is also the same configuration.

[0157] As for shift registers 702 and 708, the structure by which, as for the n channel mold TFT used for the CMOS circuit which are 5-16V (typically 10 V), and forms a circuit, driver voltage is shown by 205 of drawing 5 (C) is suitable here.

[0158] Moreover, the CMOS circuit in which level shifters 703 and 709 and buffers 704 and 710 contain the n channel mold TFT205 of drawing 5 (C) like a shift register although driver voltage becomes high with 14-16V is suitable. In addition, it is effective to make gate wiring into multi-gate structures, such as double-gate structure and triple gate structure, when raising each circuit reliability.

[0159] Moreover, since a sampling circuit 705 needs to reduce an OFF state current value when a source field and a drain field are reversed although driver voltages are 14-16V, the CMOS circuit containing the n channel mold TFT208 of drawing 9 is suitable.

[0160] Moreover, driver voltages are 14-16V, and the pixel section 706 arranges the pixel of the structure shown in drawing 1 .

[0161] In addition, the above-mentioned configuration is easily realizable by producing TFT according to the production process shown in drawing 3 -5. Moreover, although this example shows only the configuration of the pixel section and a drive circuit, if the production process of this example is followed, I think that it is possible to form logical circuits other than drive circuits, such as a signal dividing network, a D/A converter circuit, an operational amplifier circuit, and a gamma correction circuit, on the same substrate, and the memory section, a microprocessor, etc. can be formed further.

[0162] Furthermore, EL module of this example also including housing material is explained using drawing 17 (A) and (B). In addition, the sign used by drawing 6 and drawing 7 if needed will be quoted.

[0163] On the substrate (the substrate film under TFT is included) 1700, the pixel section 1701, the source side drive circuit 1702, and the gate side drive circuit 1703 are formed. Various wiring from each drive circuit results in FPC611 through the input wiring 612-614, and is connected to an external instrument.

[0164] this time -- at least -- the pixel section -- as a drive circuit and the pixel section are surrounded preferably, the housing material 1704 is formed. In addition, outside an EL element, rather than **, inside dimension is the configuration or the sheet configuration of having a large crevice, and with adhesives 1705, as the housing material 1704 forms a closed space in collaboration with a substrate 1700, it fixes to a substrate 1700. At this time, an EL element will be in the condition of having been completely enclosed with said closed space, and will be completely intercepted from the open air. In addition, two or more housing material 1704 may be formed.
[0165] Moreover, insulating matter of the quality of the material of the housing material 1704, such as glass and a polymer, is desirable. For example, amorphous glass (******** glass, quartz, etc.), crystallization glass, ceramic glass, organic system resin (acrylic resin, styrene resin, polycarbonate system resin, epoxy system resin, etc.), and silicone system resin are mentioned. Moreover, the ceramics may be used. Moreover, if adhesives 1705 are insulating matter, it is also possible to use metallic materials, such as a stainless alloy.
[0166] Moreover, the quality of the material of adhesives 1705 can use adhesives, such as epoxy system resin and acrylate system resin. Furthermore, thermosetting resin and a photo-setting resin can also be used as adhesives. However, it is required to be the quality of the material which does not penetrate oxygen and moisture as much as possible.
[0167] Furthermore, as for the opening 1706 between housing material and a substrate 1700, it is desirable to be filled up with inert gas (an argon, helium, nitrogen, etc.). Moreover, it is possible not only gas but to use inactive liquids (representing [by the perfluoro alkane] liquefied fluorination carbon etc.). It is good with an ingredient which is used by JP,8-78159,A about the inactive liquid. Moreover, it may be filled up with resin.
[0168] Moreover, it is also effective to prepare a drying agent in an opening 1706. An ingredient which is indicated by JP,9-148066,A as a drying agent can be used. What is necessary is typically, just to use the barium oxide. Moreover, it is effective not only a drying agent but to form an antioxidant.
[0169] Moreover, as shown in drawing 17 (B), two or more pixels which have the EL element isolated separately are prepared in the pixel section, and they all have the protection electrode 1707 as a common electrode. Although [this example] it is desirable to carry out continuation formation without carrying out atmospheric-air release of EL layer, cathode (MgAg electrode), and the protection electrode, if EL layer and cathode are formed using the same mask material and only a protection electrode is formed by another mask material, the structure of drawing 17 (B) is realizable.
[0170] It is not necessary to prepare EL layer and cathode on a drive circuit that what is necessary is to prepare only the pixel section at this time. Of course, although it does not become a problem even if prepared on the drive circuit, it is more desirable not to prepare, if it takes into consideration that alkali metal is contained in EL layer.
[0171] In addition, the protection electrode 1707 is connected to the input wiring 1709 in the field shown by 1708. The input wiring 1709 is wiring for giving a predetermined electrical potential difference to the protection electrode 1707, and is connected to FPC611 through the conductive paste ingredient (typically different direction conductivity film) 1710.
[0172] Here explains the production process for realizing contact structure in a field 1708 using drawing 18 .
[0173] First, the condition of drawing 5 (A) is acquired according to the process of this example. At this time, in a substrate edge (field shown by 1708 in drawing 17 (B)), the 1st interlayer insulation film 336 and gate dielectric film 311 are removed, and the input wiring 1709 is formed on it. Of course, it is formed in the source wiring of drawing 5 (A) and drain wiring, and coincidence. (Drawing 18 (A))
[0174] Next, in case the 2nd passivation film 348, the 2nd interlayer insulation film 347, and the 1st passivation film 344 are etched in drawing 5 (B), the field shown by 1801 is removed and an aperture 1802 is formed. (Drawing 18 (B))
[0175] In the pixel section, the formation process (a pixel electrode, EL layer, and formation process of cathode) of an EL element is performed in this condition. Under the present

circumstances, in the field shown in drawing 18 , an EL element is made not to be formed using mask material. And after forming cathode 351, the protection electrode 352 is formed using another mask material. Thereby, the protection electrode 352 and the input wiring 1709 are connected electrically. Furthermore, the 3rd passivation film 353 is formed and the condition of drawing 18 (C) is acquired.
[0176] Contact structure of the field shown by 1708 of drawing 17 (B) according to the above process is realized. And the input wiring 1709 is a clearance between the housing material 1704 and a substrate 1700 (however, it fills up with adhesives 1705.). That is, the thickness which can fully carry out flattening of the level difference of input wiring is required for adhesives 1705. It passes and connects with FPC611. In addition, although the input wiring 1709 was explained here, other input wiring 612-614 is similarly connected to FPC611 through the bottom of the housing material 1704.
[0177] [Example 2] This example shows a different example from the configuration which showed the configuration of a pixel to drawing 2 (B) to drawing 10 .
[0178] In this example, two pixels shown in drawing 2 (B) are arranged so that it may become symmetrical about a current supply source line. That is, as shown in drawing 10 , the number of wiring to need can be reduced by communalizing the current supply source line 213 between two adjoining pixels. In addition, the TFT structure arranged in a pixel remains as it is, and is good.
[0179] It becomes possible to produce such a configuration, then the higher definition pixel section, and the quality of an image improves.
[0180] In addition, according to the production process of an example 1, it can realize easily, and just refer to the explanation of an example 1 or drawing 1 for the configuration of this example about TFT structure etc.
[0181] [Example 3] This example explains the case where the pixel section of different structure from drawing 1 is formed, using drawing 11 . In addition, the process which forms the 2nd interlayer insulation film 44 should just follow an example 1. Moreover, since TFT201 for switching and TFT202 for current control which were covered with the 2nd interlayer insulation film 44 are the same structure as drawing 1 , explanation here is omitted.
[0182] If a contact hole is formed to the 2nd passivation film 45, the 2nd interlayer insulation film 44, and the 1st passivation film 41 in the case of this example, the pixel electrode 51, cathode 52, and the EL layer 53 will be formed. Although continuously formed in this example with the vacuum deposition method which does not carry out atmospheric-air release of cathode 52 and the EL layer 53, mask material is used in that case and EL layer of red luminescence, EL layer of green luminescence, and EL layer of blue luminescence are alternatively formed in a separate pixel at it. In addition, although only one pixel is illustrated to drawing 11 , the pixel of the same structure is formed corresponding to each color of red, green, or blue, and, thereby, color display can be performed. EL layer of each [these] color should just adopt a well-known ingredient.
[0183] In this example, the aluminium alloy film (aluminum film containing 1wt% titanium) of 150nm thickness is prepared as a pixel electrode 51. In addition, although what kind of ingredient is sufficient as long as it is a metallic material as an ingredient of a pixel electrode, it is desirable that it is an ingredient with a high reflection factor. Moreover, the thickness of the EL layer 53 may be 120nm, using the MgAg electrode of 230nm thickness as cathode 52.
[0184] Next, the anode plate 54 which consists of transparence electric conduction film (this example ITO film) is formed in the thickness of 110nm. In this way, if EL element 209 is formed and the 3rd passivation film 55 is formed as the ingredient shown in the example 1 is also, the pixel of structure as shown in drawing 11 will be completed.
[0185] When it considers as the structure of this example, the red generated by each pixel and a green or blue light are emitted to the opposite side with the substrate in which TFT was formed. Therefore, it can use as an effective luminescence field mostly, the whole region, i.e., the field in which TFT was formed, in a pixel. Consequently, the effective luminescence area of a pixel improves sharply and the brightness and the contrast ratio (ratio of light and darkness) of an image improve.

[0186] In addition, the configuration of this example can be freely combined with any configuration of examples 1 and 2.
[0187] [Example 4] This example explains the case where the pixel of different structure from drawing 2 of an example 1 is formed, using drawing 12 (A) and (B).
[0188] In drawing 12 (A), 1201 is TFT for switching and includes a barrier layer 56, gate electrode 57a, gate wiring 57b, source wiring 58, and the drain wiring 59 as a configuration. Moreover, 1202 is TFT for current control and includes a barrier layer 60, the gate electrode 61, source wiring (current supply source line) 62, and the drain wiring 63 as a configuration. Moreover, the source wiring 62 of TFT1202 for current control is connected to the current supply source line 64, and the drain wiring 63 is connected to EL element 65. Drawing 12 (B) expressed the circuitry of this pixel.
[0189] The difference between drawing 12 (A) and drawing 2 (A) is the structure of TFT for switching. In this example, 0.1-5 micrometers and thin gate electrode 57a are formed, and as line breadth crosses the part, it forms a barrier layer 56. And gate wiring 57b is formed so that gate electrode 57a of each pixel may be connected electrically. Triple gate structure is realized without this having area so chiefly.
[0190] Although other parts are the same as that of drawing 2 (A), since the area which TFT for switching has chiefly will become small if it is structure like this example, effective luminescence area becomes large, namely, the brightness of an image improves. Moreover, since gate structure which raised the redundancy for reducing an OFF state current value can be realized, improvement in the further image quality can be aimed at.
[0191] In addition, the configuration of this example may communalize the current supply source line 64 like an example 2 between the adjoining pixels, and is good also as structure like an example 3. Moreover, what is necessary is just to follow an example 1 about a production process.
[0192] [Example 5] Although examples 1-4 explained the case of the top gate mold TFT, this invention may be carried out using the bottom gate mold TFT. This example shows the case where this invention is carried out with the reverse stagger mold TFT to drawing 13 . In addition, except TFT structure, since it is the same as that of the structure of drawing 1 , the same sign as drawing 1 is used if needed.
[0193] In drawing 13 , the same ingredient as an example 1 can be used for a substrate 11 and the substrate film 12. And on the substrate film 12, TFT1301 for switching and TFT1302 for current control are formed.
[0194] The configuration of TFT1301 for switching includes the gate electrodes 70a and 70b, the gate wiring 71, gate dielectric film 72, the source field 73, the drain field 74, the LDD fields 75a-75d, the high concentration impurity range 76, the channel formation fields 77a and 77b, the channel protective coats 78a and 78b, the 1st interlayer insulation film 79, source wiring 80, and the drain wiring 81.
[0195] Moreover, the configuration of TFT1302 for current control includes the gate electrode 82, gate dielectric film 72, the source field 83, the drain field 84, the LDD field 85, the channel formation field 86, the channel protective coat 87, the 1st interlayer insulation film 79, source wiring 88, and the drain wiring 89. At this time, the gate electrode 82 is electrically connected with the drain wiring 84 of TFT1301 for switching.
[0196] In addition, what is necessary is just to form above-mentioned TFT1301 for switching, and TFT1302 for current control by the production approach of the well-known reverse stagger mold TFT. Moreover, as for (ingredients, such as wiring, an insulator layer, and a barrier layer), at least each part which forms Above TFT can use the same ingredient as each part which corresponds in the top gate mold TFT of an example 1. However, what is necessary is just to form by the insulator layer containing silicon about the channel protective coats 78a, 78b, and 87 which are not in the configuration of the top gate mold TFT. Moreover, what is necessary is to change high impurity concentration and just to form according to an individual using a photolithography technique, about formation of impurity ranges, such as a source field, a drain field, or a LDD field.
[0197] If TFT is completed, the pixel which carries out sequential formation of the 1st

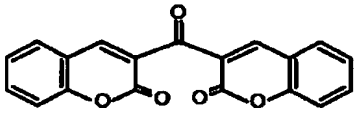
passivation film 41, a color filter 42, a fluorescent substance 43, the 2nd interlayer insulation film (flattening film) 44, the 2nd passivation film 45, the pixel electrode (anode plate) 46, the EL layer 47, the MgAg electrode (cathode) 48, the aluminum electrode (protection electrode) 49, and the 3rd passivation film 50, and has EL element 1303 will be completed. What is necessary is just to refer to an example 1 about these production processes and ingredients.
[0198] In addition, the configuration of this example can be freely combined with any configuration of examples 2-4.
[0199] [Example 6] In drawing 5 (C) of an example 1, or the structure of drawing 1 , it is effective to use the high ingredient of the heat dissipation effectiveness like the 2nd passivation film 45 as substrate film prepared between a barrier layer and a substrate. In order that especially TFT for current control may pass many currents, it is easy to generate heat, and degradation by self-generation of heat can pose a problem. In such a case, the substrate film can prevent the heat deterioration of TFT by having the heat dissipation effectiveness like this example.
[0200] Of course, it is also desirable the effectiveness protected from the movable ion diffused from a substrate and to use the laminated structure of the 1st passivation film 41, the compound which contains Si, aluminum, N, O, and M similarly, and the insulator layer containing silicon, since it is important.
[0201] In addition, the configuration of this example can be freely combined with any configuration of examples 1-5.
[0202] [Example 7] When it considers as the pixel structure shown in the example 3, since the light emitted from EL layer is emitted to the opposite side, it does not need to care about permeability, such as an insulator layer which exists between a substrate and a pixel electrode, with a substrate. That is, even if it is an ingredient with low permeability somewhat, it can use.
[0203] Therefore, it is advantageous when using the carbon film called a diamond thin film, the diamond-like carbon film, or the amorphous carbon film as the substrate film 12, the 1st passivation film 41, or the 2nd passivation film 45. That is, since it is not necessary to care about decline in permeability, thickness can be thickly set up like 100-500nm, and it is possible to heighten the heat dissipation effectiveness more.
[0204] In addition, since the decline in permeability should be too avoided about the case where the above-mentioned carbon film is used for the 3rd passivation film 50, as for thickness, it is desirable to make it about 5-100nm.
[0205] In addition, when using a carbon film for any of the substrate film 12, the 1st passivation film 41, the 2nd passivation film 45, or the 3rd passivation film 50 also in this example, it is effective to carry out a laminating to other insulator layers, and to use.
[0206] In addition, this example is effective when considering as the pixel structure shown in the example 3, and it is possible to combine with any configuration of examples 1-6 freely about other configurations.
[0207] [Example 8] In this invention, by making TFT for switching into multi-gate structure in the pixel of EL indicating equipment, the OFF state current value of TFT for switching was reduced, and the need for retention volume is eliminated. This is a device for utilizing the area of retention volume which it has chiefly effectively as a luminescence field.
[0208] however, lose retention volume completely -- the effectiveness of extending effective luminescence area only by making monopoly area small is acquired also until there is nothing. That is, it is enough by making TFT for switching into multi-gate structure to reduce an OFF state current value and just to contraction-ize monopoly area of retention volume.
[0209] Therefore, it is also possible to consider as pixel structure as shown in drawing 14 . In addition, in drawing 14 , the same sign as drawing 1 is quoted if needed.
[0210] The difference between drawing 14 and drawing 1 is a point that the retention volume 1401 connected to TFT for switching exists. Retention volume 1401 is formed with the semiconductor region (lower electrode) 1402, the gate dielectric film 18, and the capacity electrode (up electrode) 1403 which were extended from the drain field 14 of TFT201 for switching. This capacity electrode 1403 is formed in the gate electrodes 19a, 19b, and 35 and

coincidence of TFT.
[0211] Besides, a field Fig. is shown in drawing 15 (A). The sectional view which cut the plan of drawing 15 (A) with A-A' is equivalent to drawing 14 . Drawing 15 (A) The capacity electrode 1403 is electrically connected with the source field 31 of TFT for current control through the connection wiring 1404 connected electrically so that it may be shown. In addition, the connection wiring 1404 is formed in source wiring 21 and 36 and the drain wiring 22 and 37, and coincidence. Moreover, drawing 15 (B) expresses the circuitry of a plan shown in drawing 15 (A).
[0212] In addition, the configuration of this example is freely combinable with any configuration of examples 1-7. That is, retention volume is only prepared in a pixel and limitation is added to neither TFT structure nor the ingredient of EL layer.
[0213] [Example 9] In the example 1, although laser crystallization is used as means forming of the crystalline substance silicon film 302, the case where a different crystallization means is used is explained in this example.
[0214] In this example, after forming the amorphous silicon film, it crystallizes using the technique indicated by JP,7-130652,A. The technique indicated by this official report is a technique of considering as the catalyst which promotes crystallization (promotion) and obtaining the crystalline high crystalline substance silicon film using elements, such as nickel.
[0215] Moreover, after a crystallization process is completed, the process which removes the catalyst used for crystallization may be performed. In that case, what is necessary is just to carry out gettering of the catalyst with the technique indicated by JP,10-270363,A or JP,8-330602,A.
[0216] Moreover, TFT may be formed using the technique indicated by the application specification of Japanese Patent Application No. 11-076967 by these people.
[0217] As mentioned above, the production process shown in the example 1 is one example, and if the structure of drawing 5 (C) of drawing 1 or an example 1 is realizable, it will be satisfactory even if it uses other production processes.
[0218] In addition, the configuration of this example can be freely combined with any configuration of examples 1-8.
[0219] [Example 10] In driving EL display of this invention, the analog drive using the analog signal as a picture signal can also be performed, and the digital drive using a digital signal can also be performed.
[0220] When performing an analog drive, an analog signal is sent to the source wiring of TFT for switching, and an analog signal including the gradation information serves as gate voltage of TFT for current control. And the current which flows to an EL element is controlled by TFT for current control, the luminescence reinforcement of an EL element is controlled, and a gradation display is performed. In this case, as for TFT for current control, it is desirable to make it operate in a saturation region. That is, it is desirable to make it operate within the condition of $|Vds|>|Vgs-Vth|$. In addition, Vds is [the electrical potential difference between a source field and a gate electrode and Vth of the electrical potential difference between a source field and a drain field and Vgs] the threshold electrical potential differences of TFT here.
[0221] On the other hand, when performing a digital drive, unlike an analog gradation display, the gradation display called a time-sharing drive (time amount gradation drive) or an area gradation drive is performed. That is, by adjusting the die length and the rate of luminescence surface ratio of luminescence time amount, it shows as color gradation is changing visually. In this case, as for TFT for current control, it is desirable to make it operate in a linearity field. That is, it is desirable to make it operate within the condition of $|Vds|<|Vgs-Vth|$.
[0222] Since the speed of response is very quick compared with a liquid crystal device, an EL element can be driven at high speed. Therefore, it can be said that it is a component suitable for the time-sharing drive which divides one frame into two or more subframes, and performs a gradation display. Moreover, it can be said that it is advantageous when the time amount holding the gate voltage of TFT for current control is also short, it ends, and retention volume is made small or it omits, since the one-frame period is short.

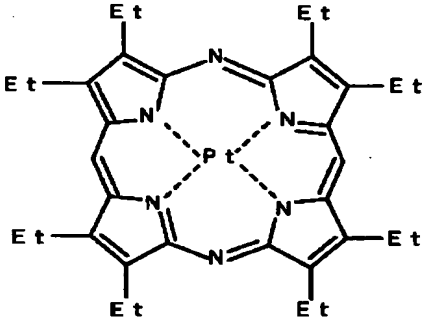
[0223] Thus, since this invention is a technique about component structure, the drive approach may be what kind of thing.
[0224] [Example 11] This example shows the example of the pixel structure of EL display of this invention to drawing 21 (A) and (B). in addition, this example — setting — 4701 — the source wiring of TFT4702 for switching, and 4703 — in TFT for current control, and 4705, TFT for power control and 4707 make it as gate wiring for power control, and 4708 makes a current supply source line and 4706 an EL element for gate wiring of TFT4702 for switching, and 4704. About actuation of TFT4706 for power control, it is good to refer to Japanese Patent Application No. No. 341272 [11 to].
[0225] Moreover, although TFT4706 for power control is formed between TFT4704 for current control, and EL element 4708 in this example, it is good also as structure where TFT4704 for current control was formed between TFT4706 for power control, and EL element 4708. Moreover, as for TFT4706 for power control, it is desirable to consider as the same structure as TFT4704 for current control, or to carry out a serial by the same barrier layer, and to form.

[0226] Moreover, drawing 21 (A) is an example at the time of making the current supply source line 4705 common between two pixels. That is, the description is formed so that two pixels may serve as axial symmetry focusing on the current supply source line 4705. In this case, since the number of a current supply source line can be reduced, the pixel section can be further made highly minute.
[0227] Moreover, drawing 21 (B) is an example at the time of forming the current supply source line 4710 in parallel with the gate wiring 4703, and forming the gate wiring 4711 for power control in parallel with source wiring 4701. In addition, although it has structure established so that the current supply source line 4710 and the gate wiring 4703 might not lap in drawing 21 (B), if it is wiring formed in the layer from which both differ, it can also prepare so that it may lap on both sides of an insulator layer. In this case, since the current supply source line 4710 and the gate wiring 4703 can be made to share monopoly area, the pixel section can be further made highly minute.
[0228] [Example 12] This example shows the example of the pixel structure of EL display of this invention to drawing 22 (A) and (B). in addition, this example — setting — 4801 — the source wiring of TFT4802 for switching, and 4803 — in TFT for current control, and 4805, TFT for elimination and 4807 make it as gate wiring for elimination, and 4808 makes a current supply source line and 4806 an EL element for gate wiring of TFT4802 for switching, and 4804. About actuation of TFT4806 for elimination, it is good to refer to Japanese Patent Application No. No. 338786 [11 to].
[0229] It can connect with the gate of TFT4804 for current control, and the drain of TFT4806 for elimination can change now compulsorily the gate voltage of TFT4804 for current control. In addition, although TFT4806 for elimination is good also as a p channel mold TFT also as an n channel mold TFT, it is desirable to consider as the same structure as TFT4802 for switching so that the OFF state current can be made small.
[0230] Moreover, drawing 22 (A) is an example at the time of making the current supply source line 4805 common between two pixels. That is, the description is formed so that two pixels may serve as axial symmetry focusing on the current supply source line 4805. In this case, since the number of a current supply source line can be reduced, the pixel section can be further made highly minute.
[0231] Moreover, drawing 22 (B) is an example at the time of forming the current supply source line 4810 in parallel with the gate wiring 4803, and forming the gate wiring 4811 for elimination in parallel with source wiring 4801. In addition, although it has structure established so that the current supply source line 4810 and the gate wiring 4803 might not lap in drawing 22 (B), if it is wiring formed in the layer from which both differ, it can also prepare so that it may lap on both sides of an insulator layer. In this case, since the current supply source line 4810 and the gate wiring 4803 can be made to share monopoly area, the pixel section can be further made highly minute.
[0232] [Example 13] EL display of this invention is good also as structure which prepared how

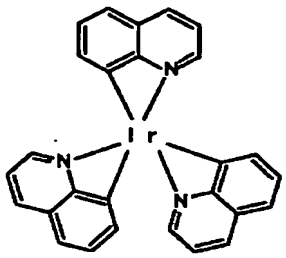
many TFT(s) in the pixel. Although examples 11 and 12 show the example which prepared three TFT(s), four thru/or six TFT(s) may be prepared. This invention can be carried out without being limited to the pixel structure of EL display.
[0233] [Example 14] This example explains the example at the time of using the p channel mold TFT as TFT202 for current control of drawing 1 . In addition, since other parts are the same as that of drawing 1 , detailed explanation is omitted.
[0234] The cross-section structure of the pixel of this example is shown in drawing 23 . The production approach of the p channel mold TFT used by this example should just refer to an example 1. Including the source field 91, the drain field 92, and the channel formation field 93, the source field 91 is connected to source wiring 36, and the drain field 92 is connected to the drain wiring 37 for the barrier layer of the p channel mold TFT.
[0235] Thus, when the anode plate of an EL element is connected to TFT for current control, it is desirable to use the p channel mold TFT as TFT for current control.
[0236] In addition, it combines with any configuration of examples 1-13 freely, and the configuration of this example can be carried out.
[0237] [Example 15] In this invention, external luminescence quantum efficiency can be raised by leaps and bounds by using EL ingredient which can use the phosphorescence from a triplet exciton for luminescence. Thereby, low-power-izing of an EL element, reinforcement, and lightweight-ization are attained. Here, a triplet exciton is used and the report which raised external luminescence quantum efficiency is shown.
(T. Tsutsui, C.Adachi, S.Saito, Photochemical Processes in Organized Molecular Systems, ed.KHonda (Elsevier Sci.Pub., Tokyo, 1991), p.437.) The molecular formula of EL ingredient (coumarin coloring matter) reported to the above-mentioned paper is shown below.
[0238]
[Formula 8]



[0239] (M. A.Baldo, D.F.O'Brien, Y.You, A.Shoustikov, S.Sibley, M.E.Thompson, S.R.Forrest, Nature 395 (1998) p.151.) The molecular formula of EL ingredient (Pt complex) reported to the above-mentioned paper is shown below.
[0240]
[Formula 9]



[0241] It Lamansk(ies). M. — A.Baldo and S. — P. E.Burrrows and M.E.Thompson, S. — R.Forrest, Appl.Phys.Lett., and 75 (1999) p.4. (it Watanabe(s) T. — Tsutsui, M.-J.Yang, M.Yahiro, KNakamura, and T. —) T. (1999) The molecular formula of EL ingredient (Ir complex) reported to tsuji, Y.Fukuda, T.Wakimoto, S.Mayaguchi, Jpn.Appl.Phys., and the 38 (12B) L1502. above-mentioned paper is shown below.
[0242]
[Formula 10]



[0243] If phosphorescence luminescence from a triplet exciton can be used as mentioned above, implementation of one 3 to 4 times the high external luminescence quantum efficiency of this will be attained from the case where the firefly luminescence from a singlet exciton is used theoretically. In addition, it combines with any configuration of an example 1 - an example 14 freely, and the configuration of this example can be carried out.
[0244] [Example 16] Although [an example 1] it is desirable to use an organic electroluminescence ingredient as an EL layer, even if this invention uses inorganic EL ingredient, it can be carried out. However, since driver voltage is very high, the present inorganic EL ingredient must use TFT which has the proof-pressure property that such driver voltage can be borne, when performing an analog drive.
[0245] Or if inorganic EL ingredient with prospective still lower driver voltage is developed, applying to this invention is possible.
[0246] Moreover, the configuration of this example can be freely combined with any configuration of examples 1-14.
[0247] [Example 17] Since the active-matrix mold EL indicating equipment (EL module) formed by carrying out this invention is a spontaneous light type, it is excellent in the visibility in a bright location compared with the liquid crystal display. Therefore, an application is large as an EL display (the display display incorporating EL module is pointed out) of a direct viewing type.
[0248] In addition, the size of an angle of visibility is mentioned as one of the points with a more advantageous EL display than a liquid crystal display. Therefore, it is good to use the EL display of this invention for appreciating TV broadcast etc. by the big screen as a display display (display monitor) of 30 inches or more (typically 40 inches or more) of vertical angles.
[0249] Moreover, it not only uses as EL displays (a personal computer monitor, the monitor for TV broadcast reception, advertising display monitor, etc.), but it can use as a display display of various electronic instruments.
[0250] As such an electronic instrument, the picture reproducer (equipment equipped with the display which specifically reproduces record media, such as a compact disk (CD), a laser disc (trademark) (LD), or a digital videodisc (DVD), and can display the image) equipped with a video camera, a digital camera, a goggles mold display (head mount display), car navigation, a personal computer, Personal Digital Assistants (a mobile computer, a cellular phone, or digital book), and a record medium etc. is mentioned. The example of these electronic instruments is shown in drawing 16 .
[0251] Drawing 16 (A) is a personal computer and contains a body 2001, a case 2002, a display 2003, and a keyboard 2004. This invention can be used for a display 2003.
[0252] Drawing 16 (B) is a video camera and contains a body 2101, a display 2102, the voice input section 2103, the actuation switch 2104, a dc-battery 2105, and the television section 2106. This invention can be used for a display 2102.
[0253] Drawing 16 (C) is a goggles mold display, and contains a body 2201, a display 2202, and the arm section 2203. This invention can be used for a display 2202.
[0254] Drawing 16 (D) is a pocket mold (mobile) computer, and contains a body 2301, the camera section 2302, the television section 2303, the actuation switch 2304, and a display 2305. This invention can be used for a display 2405.
[0255] drawing 16 — (— E —) — a record medium — having had — picture reproducer (specifically DVD regenerative apparatus) — it is — a body — 2401 — record media (CD, LD, or DVD) — 2402 — actuation — a switch — 2403 — a display — (— a —) — 2404 — a

display -- (-- b --) -- 2405 -- containing . This invention can be used for these displays (a) and (b), although a display (a) mainly displays image information and a display (b) mainly displays text. In addition, this invention can be used for CD regenerative apparatus, a game device, etc. as picture reproducer equipped with the record medium.
[0256] Drawing 16 (F) is an EL display and contains a case 2501, susceptor 2502, and a display 2503. This invention can be used for a display 2503. Especially the EL display of this invention is advantageous when it big-screen-izes, and it is advantageous to the display of 10 inches or more (30 inches or more of vertical angles [Especially]) of vertical angles.
[0257] Moreover, if the luminescence brightness of EL ingredient will become high in the future, it will also become possible to use for the projector of a front mold or a rear mold.
[0258] Moreover, the above-mentioned electronic instrument displays more often the information distributed through electronic communication lines, such as the Internet and CATV (cable television), and its opportunity to display especially animation information has been increasing. Since the speed of response of EL ingredient is very high, it is suitable for performing such a movie display.
[0259] Moreover, in order that the part which is emitting light may consume power, as for EL display, it is desirable to display information that the amount of light-emitting part decreases as much as possible. Therefore, when using EL display for the display which is mainly concerned with text like a Personal Digital Assistant especially a cellular phone, or a car audio, it is desirable to drive so that text may be formed by part for a light-emitting part by making a part for a non-light-emitting part into a background.
[0260] Drawing 20 (A) is a cellular phone and contains a body 2601, the voice output section 2602, the voice input section 2603, a display 2604, the actuation switch 2605, and an antenna 2606 here. EL display of this invention can be used for a display 2604. In addition, a display 2604 can stop the power consumption of a cellular phone by displaying a white alphabetic character on a black background.
[0261] Moreover, drawing 20 (B) is an audio for mount (car audio), and includes a body 2701, a display 2702, and the actuation switches 2703 and 2704. EL display of this invention can be used for a display 2702. Moreover, although this example shows the audio for mount, you may use for a non-portable audio. In addition, a display 2704 can stop power consumption by displaying a white alphabetic character on a black background.
[0262] As mentioned above, the applicability of this invention is very wide, and applying to the electronic instrument of all fields is possible. Moreover, even if the electronic instrument of this example uses the configuration which consists of combination like an example 1 - 16 throats, it is realizable.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the cross-section structure of the pixel section of EL display.
[Drawing 2] Drawing showing the top-face structure and the configuration of the pixel section of EL display.
[Drawing 3] Drawing showing the production process of a active-matrix mold EL display.
[Drawing 4] Drawing showing the production process of a active-matrix mold EL display.
[Drawing 5] Drawing showing the production process of a active-matrix mold EL display.
[Drawing 6] Drawing showing the appearance of EL module.
[Drawing 7] Drawing showing the circuit block configuration of EL indicating equipment.
[Drawing 8] Drawing which expanded the pixel section of EL display.
[Drawing 9] Drawing showing the component structure of the sampling circuit of EL display.
[Drawing 10] Drawing showing the configuration of the pixel section of EL display.
[Drawing 11] Drawing showing the cross-section structure of the pixel section of EL display.
[Drawing 12] Drawing showing the top-face structure and the configuration of the pixel section of EL display.
[Drawing 13] Drawing showing the cross-section structure of the pixel section of EL display.
[Drawing 14] Drawing showing the cross-section structure of the pixel section of EL display.
[Drawing 15] Drawing showing the top-face structure and the configuration of the pixel section of EL display.
[Drawing 16] Drawing showing the example of an electronic instrument.
[Drawing 17] Drawing showing the appearance of EL module.
[Drawing 18] Drawing showing the production process of contact structure.
[Drawing 19] Drawing showing the laminated structure of EL layer.
[Drawing 20] Drawing showing the example of an electronic instrument.
[Drawing 21] Drawing showing the circuitry of the pixel section of EL display.
[Drawing 22] Drawing showing the circuitry of the pixel section of EL display.
[Drawing 23] Drawing showing the cross-section structure of the pixel section of EL display.

[Translation done.]

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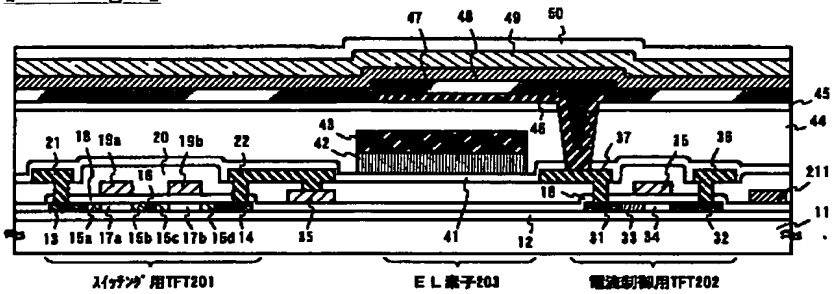
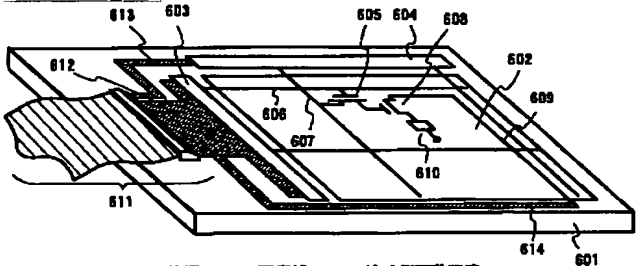
DRAWINGS

[Drawing 1]



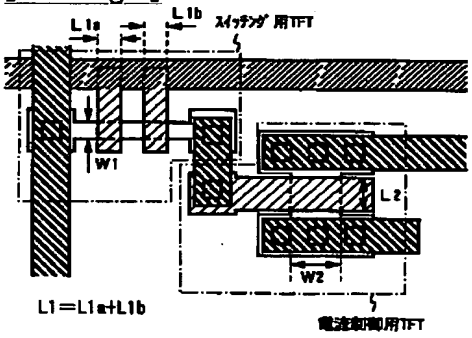
11:基板 12:下地膜 13:ソース領域 14:ドレイン領域 15a～15d:LDD領域 16:高濃度不純物領域
17a, 17b:チャネル形成領域 18:ゲート絶縁膜 19a, 19b:ゲート電極 20:第1層間絶縁膜 21:ソース配線
22:ドレイン配線 23:ゲート電極 31:ソース領域 32:ドレイン領域 33:LDD領域 34:チャネル形成領域
35:ゲート電極 36:ソース配線 37:ドレイン配線 41:第1パッシベーション膜 42:カラーフィルター
43:発光体（色変換層） 44:第2層間絶縁膜 45:第2パッシベーション膜 46:画素電極（陽極）
47:EL層 48:陰極 49:保護電極 50:第3パッシベーション膜

[Drawing 6]

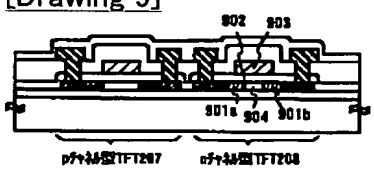


601：基板 602：画素部 603：ゲート側駆動回路
604：ソース側駆動回路 605：スイッチング用TFT 606：ゲート配線
607：ソース配線 608：電流制御用TFT 609：電流供給線
610：EL素子 611：FPC 612～614：入力配線

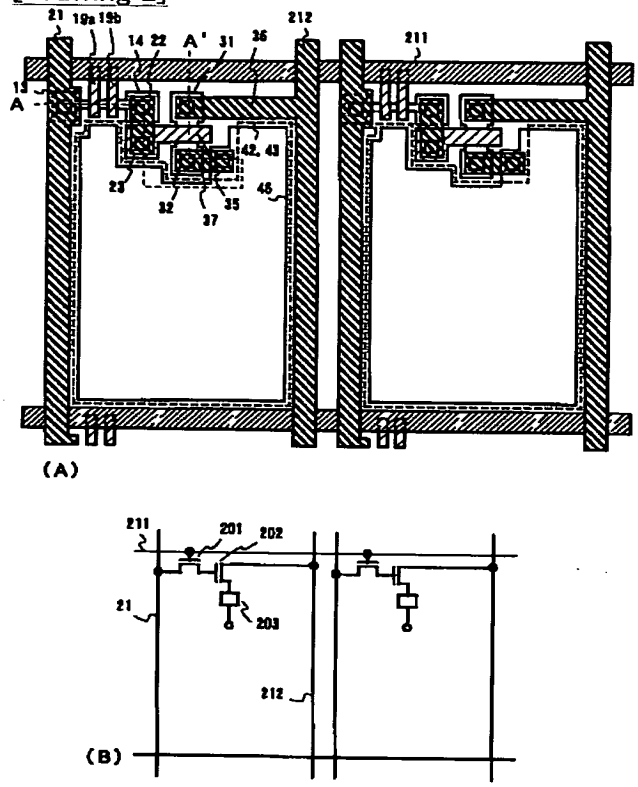
[Drawing 8]



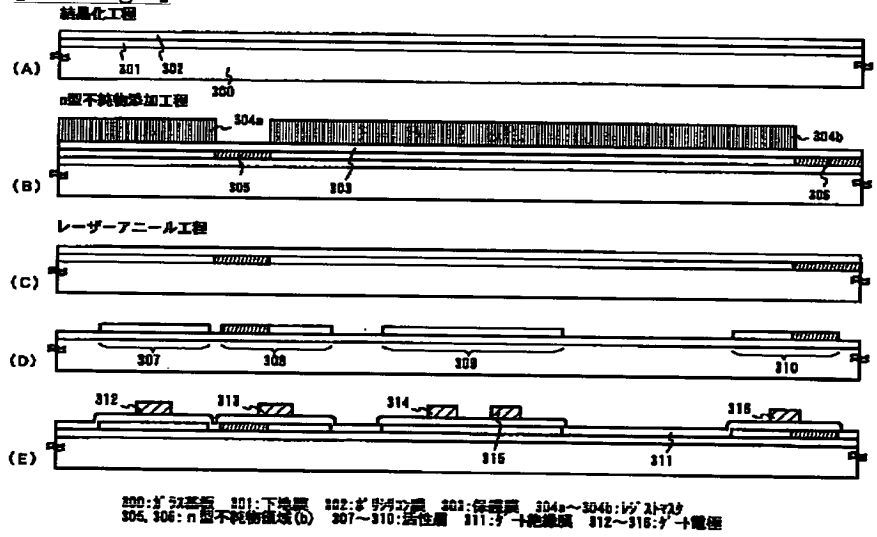
[Drawing 9]



[Drawing 2]

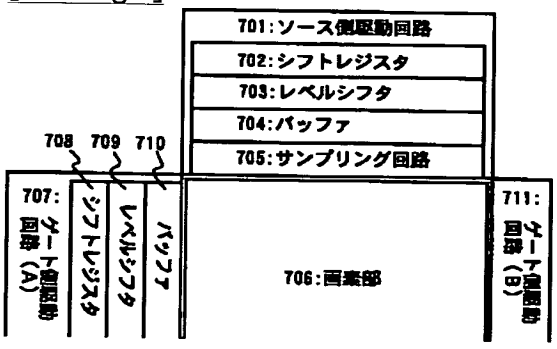


[Drawing 3]

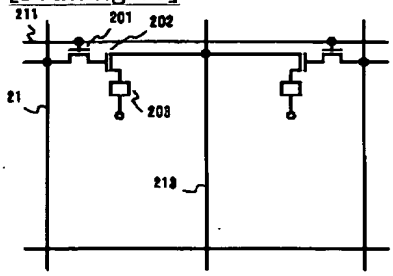


300:ガラス基板 301:下地膜 302:ガラス膜 303:保護膜 304a～304b:レジストマスク
305, 306:n型不純物領域(b) 307～310:活性層 311:ゲート絶縁膜 312～316:ゲート電極

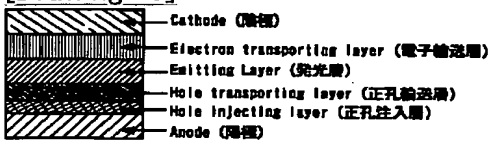
[Drawing 7]



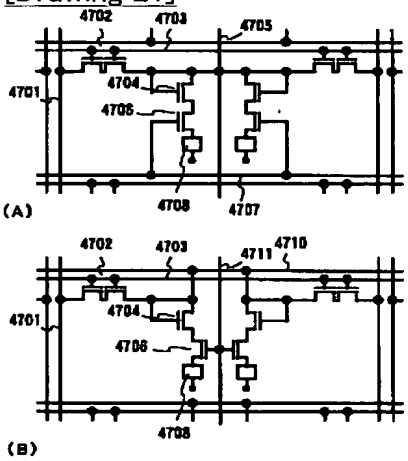
[Drawing 10]



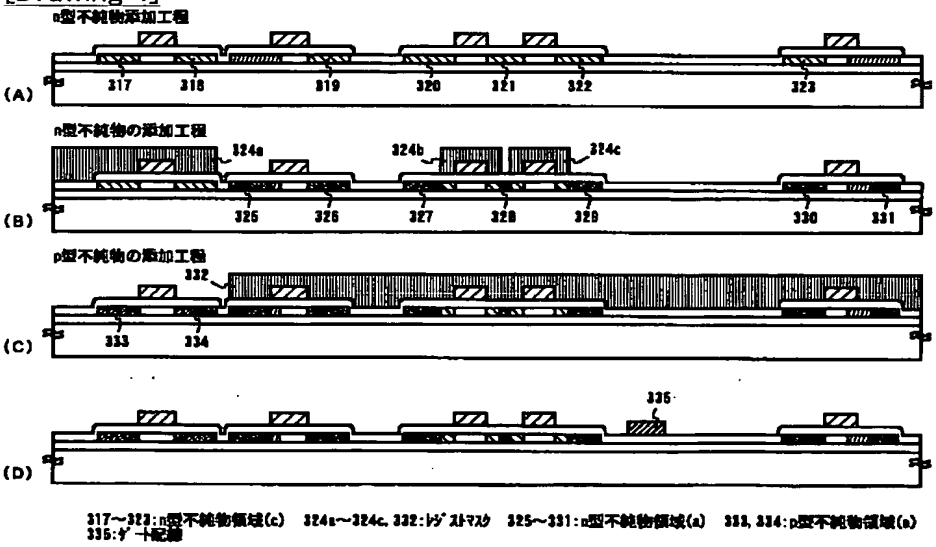
[Drawing 19]



[Drawing 21]

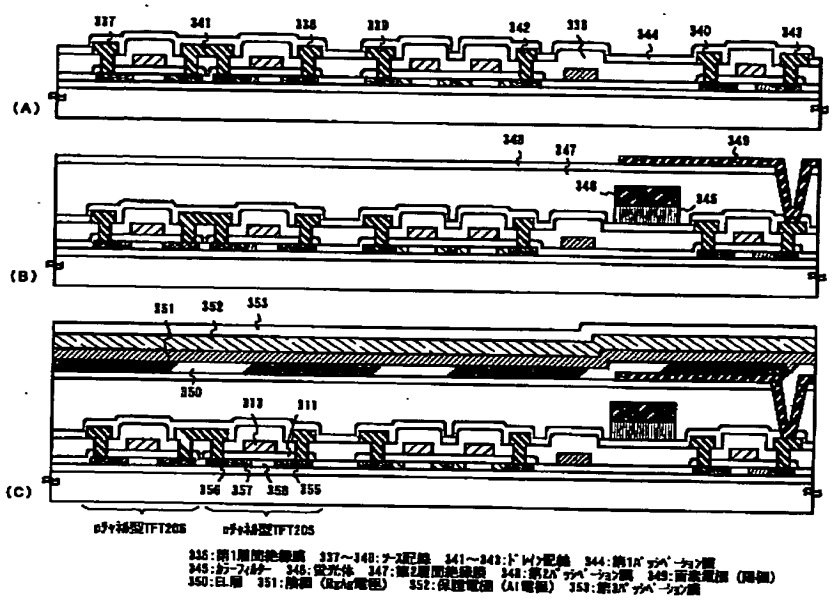


[Drawing 4]

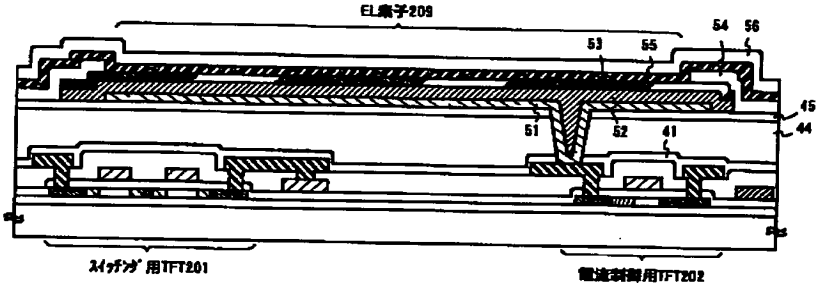


317～323:n型不純物領域(c) 324a～324c, 332:ﾄﾚｼﾞｽﾄﾏｽｸ 325～331:n型不純物領域(a) 333, 334:p型不純物領域(a)
335:ｹﾞｰﾄ配線

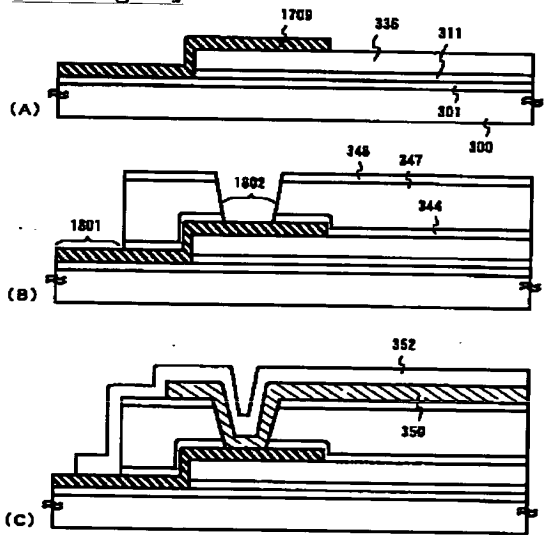
[Drawing 5]



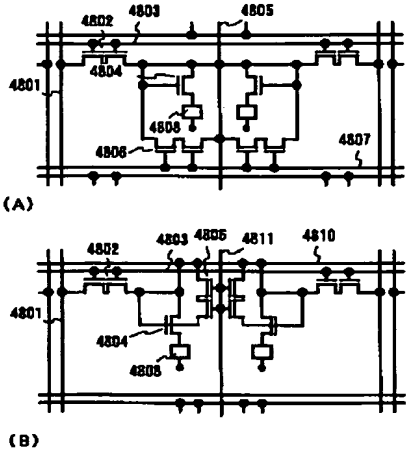
[Drawing 11]



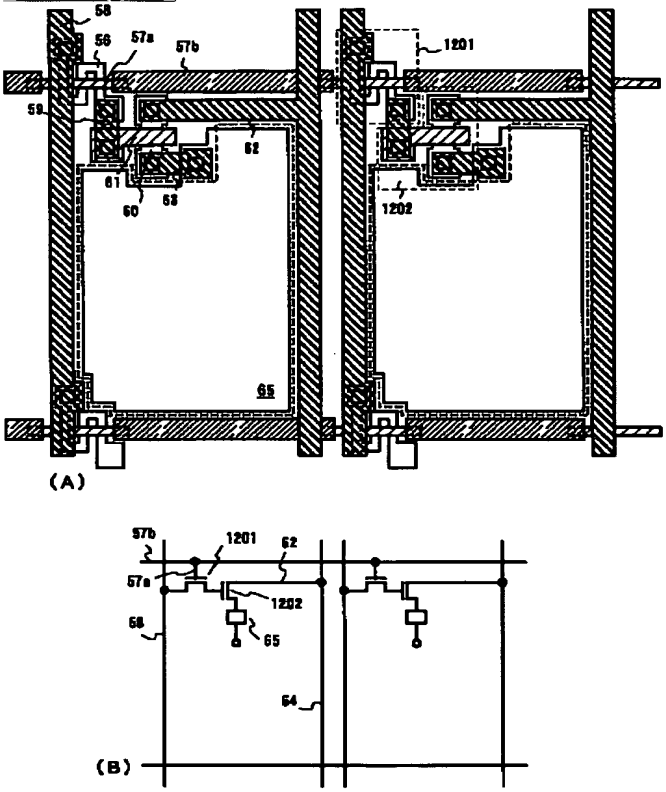
[Drawing 18]



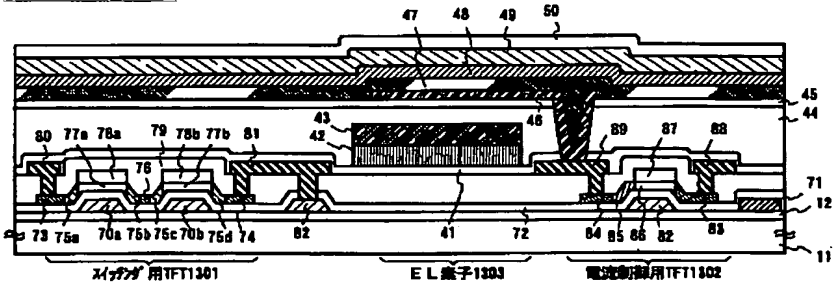
[Drawing 22]



[Drawing 12]

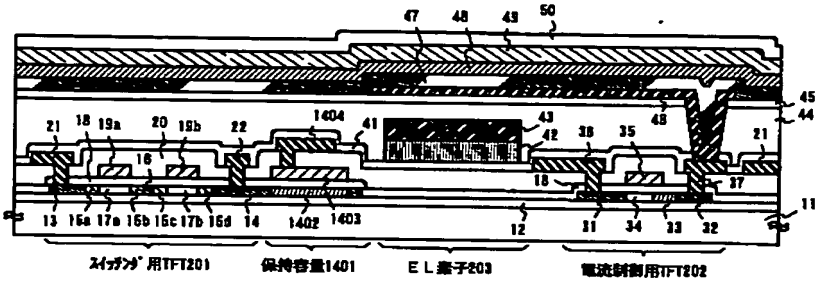


[Drawing 13]

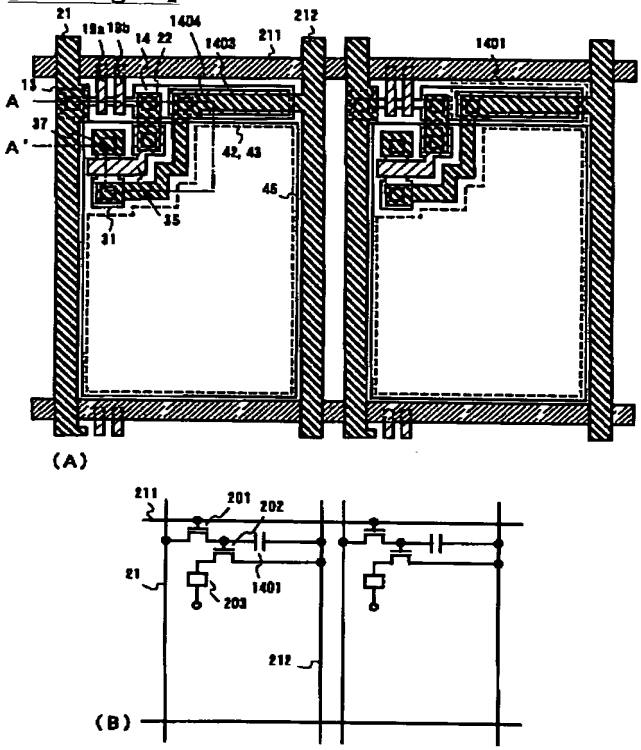


11:基板 12:下地膜 70a, 70b:ゲート電極 71:ゲート配線 72:ゲート絶縁膜 73:ソース領域 74:ドレイン領域
75a～75d:LDD領域 76:高濃度不純物領域 77a, 77b:チャネル形成領域 78a, 78b:チャネル保護膜 79:第1層間絶縁膜
80:ソース配線 81:ドレイン配線 82:ゲート電極 83:ソース領域 84:ドレイン領域 85:LDD領域 86:チャネル形成領域
87:チャネル保護膜 88:ソース配線 89:ドレイン配線 41:第1パッシベーション膜 42:カラーフィルター 43:蛍光体(色変換層)
44:第2層間絶縁膜 45:第2パッシベーション膜 46:画素電極(陽極) 47:EL層 48:陰極 49:保護電極
50:第3パッシベーション膜

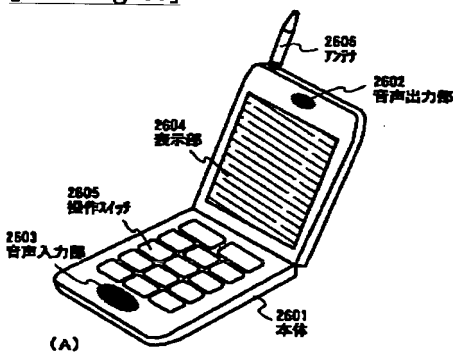
[Drawing 14]

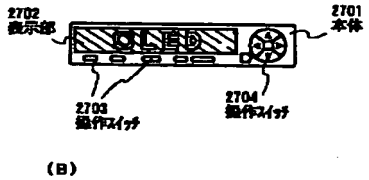


[Drawing 15]

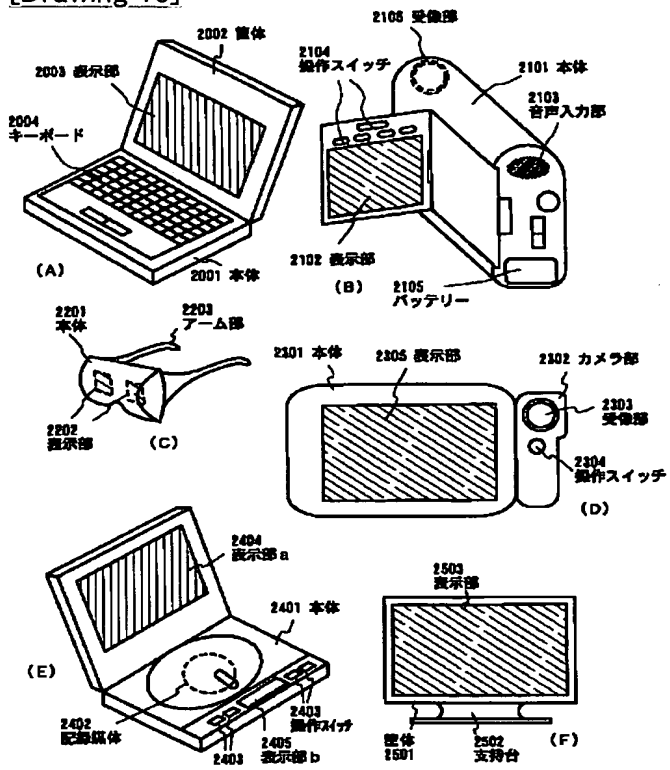


[Drawing 20]

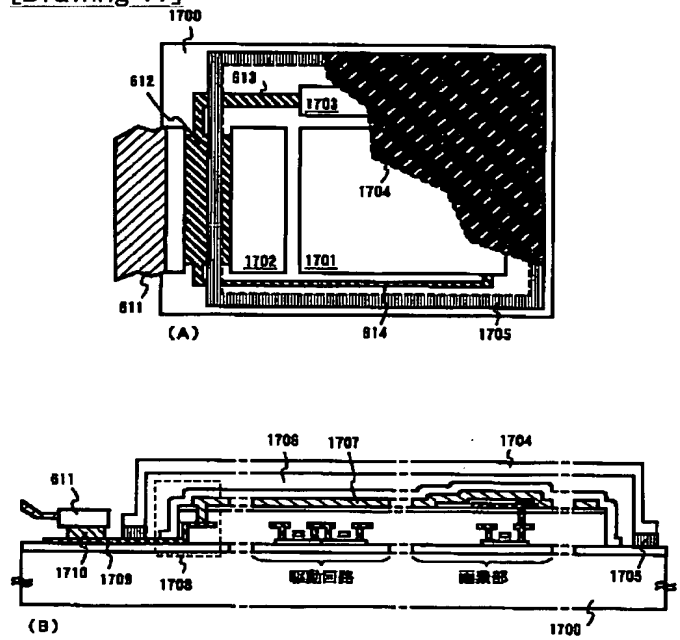




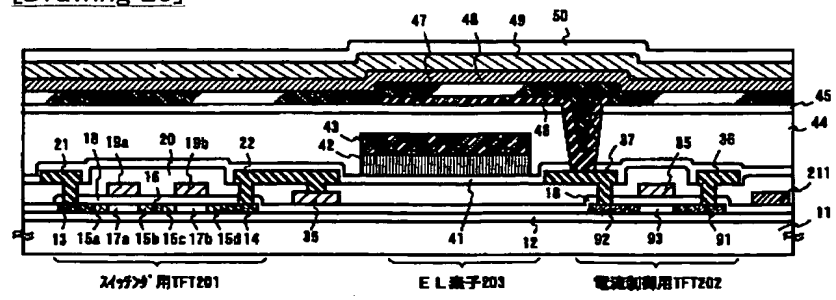
[Drawing 16]



[Drawing 17]



[Drawing 23]



[Translation done.]